The

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Electrical Contracting.

WE have pleasure in congratulating the Electrical Contractors' Association—the oldest trade organisation of the British electrical industry—upon the full measure of success that attended its first annual Convention. Formed more than a quarter of a century ago in an electrical environment very different from that which obtains to-day, it has passed through many periods of change, but it has never come out into the open so effectively as it did during the latter half of last week at Brighton. Never before have so many of its members met together. As a result of this fraternisation, and the discussion of so many matters of common interest, members will doubtless have a new sense of importance and responsibility, while new members should be attracted to its ranks.

The Association has had its years of comparative calm and its years of campaign and propaganda; changing conditions and the growth of the electrical industry with the establishment of associations representing other sectional interests have brought new problems but also new opportunities. It has been our privilege to note the progress that has been made during the whole of the period since we assisted at its formation, and with our knowledge of the trade as it exists to-day and of the problems with which it is faced, we feel convinced that the need for the Association to-day is as great as ever it was. Its record of useful work abundantly justifies its existence; and the valuable experience stored in the minds of its leaders, committee-men and executive, as well as in its archives, goes far to equip it as an organisation to enter with a right view and an appropriate attitude the new and larger field of electrical installation work that is opening out.

The president, Mr. T. E. Alger, fittingly chose the occasion of this first Convention for giving a review of the history, the aims, and the achievements of the Asso-

ciation and its allied organisations. He endeavoured to prove that as a body the contractors right from the beginning had had a programme that was "definitely constructive in character," and that the E.C.A. had always been ready to avail itself of opportunities for helpful negotiations with other sections of the industry. It has been afforded excellent opportunities for that purpose during the past year, and there is reason to hope that at last an agreement has been reached which if nothing untoward happens, may find its way into the Electricity Supply legislation of 1926.

Some of our readers will recall that one of the troubles that gave rise to the formation of the Association was the unsatisfactory position of contractors who suffered from the direct-dealing operations of manufacturers with the public. This question persists still, but it has passed through several phases. Many arrangements have been entered into between contracting, trading and manufacturing organisations, under which a greater measure of stability has resulted for some if not for all parties, but the Association has lately been finding many new and important opportunities for those "helpful negotiations," and it is bound to continue to do so. The subject of co-operation between different interests, and especially between contractors and electricity suppliers was before the Conference, but the discussion seemed to open no new ground. One thing that is plain is that no association which represents a sectional interest can have a monopoly of wisdom, and the appreciation of the standpoint of other bodies and a willingness to consider the best interests of the entire industry are essential. Conflicting interests and other views regarding the requirements of the industry have no doubt dictated the policies of sectional organisations in the past—inevitably so. It may be true, as Mr. Alger stated, that if there be as great a need, or greater, for inter-sectional conference to-day than there was 25 years ago, the blame therefor does not lie at the door of the contractor. We are less concerned to allot blame for the past than to foster the disposition to find a common ground for harmonious negotiation. We therefore welcome the good intention that we presume to be behind the president's remark that the time was more than ripe for all sections of the industry to get together and work together in closest harmony and understanding for the common good. He testified to the growing spirit of co-operative amity that was developing throughout the electrical brotherhood; found support in the fact that everywhere now Die-hards and Last Ditchers were out of fashion; and said that the different electrical organisations showed an ever-growing disposition to appreciate each other's difficulties. Some reference to the subject of co-operation between the different interests, and the opportunity for burying the hatchet, will be found in our report of Mr. Dunlop's speech at the I.M.E.A. dinner.

This is all very good. We want to see all sections of the industry prosperous—manufacturers, contractors and electricity suppliers—as a result of ever-increasing electrical development which shall take place among the population of these islands and in the Empire and foreign markets, because electrical service is brought within the compass of the people.

We fully agree with Mr. Alger and all others who say that the electrical industry in this country is on the eve of a period of great prosperity. If we enter upon that period filled with the aforesaid spirit of co-operative amity, we shall conserve the fruits of our industry. The enrolment of additional eligible contractors from all parts of the kingdom to swell the ranks of the Association, and the strengthening of the Register of Electrical Contractors, are points upon which emphasis must be laid. These are means for consolidating the professional status of the installation engineer and assuring his commercial security, for it is only by the E.C.A. and its allied organisations being fully representative that they can speak with a voice of full authority and force.

Research in Illumination.

THE work of the Illumination Research Committee, operating under the ægis of the Department of Scientific and Industrial Research, has recently been summarised in a readable introductory report issued by H.M. Stationery Office. It was again surveyed in a paper, referred to elsewhere in this issue, which was read by Mr. W. W. T. Walsh before the Illuminating Engineering Society last month. A few months ago the Society provided an opportunity for the discussion of the various B.E.S.A. specifications bearing on illumination, and in dealing with this other series of problems it has again demonstrated its utility in acting as a clearing house for information. It is very desirable that the work of committees should be periodically reviewed in this way, otherwise their activities may be in danger of being overlooked and a great part of the benefit of the research work thus lost.

It cannot too strongly be emphasised that the production of a report is only half the battle, for it is at least as important that the people concerned should read it and apply its conclusions. We understand that the results of a number of the researches undertaken by this Committee will be published shortly as separate reports, and we hope that they, too, will be examined thoroughly and discussed. Many of the problems are of direct interest to electrical engineers, and the analysis of the effect of conditions of illumination on the speed and accuracy of printing processes will be awaited with keen interest. Some indication of the scope of this work has already been given, and we gather that advocates of better lighting will have no reason to be disappointed with the conclusions. The practical importance of an authoritative and careful series of experiments such as this can scarcely be overestimated. The Committee seems to have taken every precaution to secure trustworthy results and acted wisely in inviting the co-operation of the Joint Industrial Council of the Printing Trades. In several respects—notably its representative character—it is specially fitted to deal with research of this character. Incidentally, it is interesting to observe how all the various committees and bodies concerned with illumination have become closely interlinked, with the Illuminating Engineering Society acting as the "liaison officer."

The Progress of the Electricity Bill.

THE slow rate at which Standing Committee C is dealing with the Electricity (Supply) Bill is trying the patience of the Government, and last week Sir Douglas Hogg accused some of the members of pursuing obstructive tactics with a view to preventing the passage of the Bill; their action, he said, must react unfavourably upon the electrical industry, and on "the unhappy consumers." The *Daily Mail*, commenting on its slow progress, described the Bill as "a non-party measure, brought forward by the Government with an overwhelming weight of expert opinion behind it," to remedy the results of the mistaken legislation of the past.

In both cases, it will be seen, the assumption is made that the Bill is capable of doing what it purports to do; but that is precisely the question at issue. In its unamended condition it certainly offered no prospect of materially cheapening the supply of electricity or facilitating the development of the industry: on the contrary, as we have pointed out, the huge expenditure of an unremunerative character that was foreshadowed in all probability would have increased the cost to the consumer. Drastic amendment was and is essential—otherwise we shall be in worse case when the Bill is passed than we are now. The fault lies with the Government, which did not consult the industry before launching its scheme.

As for the "overwhelming weight of expert opinion" cited by the *Mail*, we know that the Council of the Institution of Electrical Engineers, the I.M.E.A. in special general meeting, and many other authorities of the first rank have categorically condemned the Bill; the overwhelming weight is in the other scale.

Railway Electrification in Brazil.

A Metropolitan-Vickers 2,340-h.p. Electric Locomotive for the Paulista Railway.

WHAT is claimed to be the most powerful electric locomotive yet constructed in Great Britain was recently completed at the Trafford Park works of the Metropolitan-Vickers Electrical Company for service on the Paulista Railway in Brazil, where one of the most important railway electrification schemes in America is being rapidly developed as part of an extensive plan for converting the principal Brazilian railways from steam to hydro-electric operation.

Fig. 1.—Map of the Paulista Railway and Connecting Lines.

The line being electrified (fig. 1) serves an area very rich in the production of coffee, cereals, hides, and meat, and at its lower terminus joins the Sao Paulo railway, which connects with the important seaport of Santos. The traffic on this line is very dense and the service important.

Electrification of the first section of the line, from Jundiahy to Campinas, a distance of 27 miles, was completed in 1922; by 1925 electrical operation had been extended by 31 miles to Tatú, and by the end of 1926 it is expected that the service will reach Rio Claro, making a total length of 83 miles of line electrified. Further extensions are planned for the section to S. Carlos, which will make the total length 128 miles. The equipment at present in operation includes ten freight, six passenger, and five shunting locomotives, all of American construction.

The new "Metrovick" locomotive (fig. 2) is for passenger service on 5 ft. 3 in. track; it is of the 2-6-0, 0-6-2 type, and is equipped with six motors developing a total of 2,340 h.p., and weighs 100 tons. It is thus not only the most powerful electric locomotive yet constructed in this country, but also, with one exception, the largest, its weight being exceeded only by the 110-ton high-speed passenger locomotive built by the Metropolitan-Vickers Electrical Co. for experimental work in connection with the proposed electrification of the Newcastle to York section of the London and North-Eastern Railway.

The general construction and principal dimensions of the Paulista locomotive are shown in fig. 3. The body structure is carried on two trucks, each having three motor-driven axles and a single guiding axle. The trucks are coupled together by an articulated ball joint, and the body is supported on two pivots, which engage in centres placed in such a position on the bogie units as to give the desired loading on the rail. One of the pivot centres is allowed a longitudinal sliding movement, so that while the distance apart of the body centres remains unchanged, the units can accommodate themselves to the varying positions required when negotiating curves. The pony truck is centrally loaded with a cross-compensated beam connected to the springs of the leading drivers, and the springs of the middle and hind drivers are connected by beams at the sides, thus making a very flexible wheel arrangement.

Operation is at 3,000 volts direct current, collected from overhead wires (rail return) by two pantographs, which are raised by means of compressed air with cylinder valves operated electrically or manually, and spring control allows the pantographs to follow variations in height of the overhead wires from 15 to 22 ft. above rail level.

The motors, which are of 390 h.p. each, are of the axle-mounted type, and transmit their power to the axles and driving wheels by means of flexible spur gearing. They are wound for 1,500 volts and insulated for 3,000 volts, and at least two are always in series across the line voltage; field control is used, the field being weakened by a single tap, an arrangement which gives a high balancing speed and a low starting speed with minimum resistance losses. For starting, three combinations are used: the first places six motors in series, the second two parallel groups of three motors in series, and the third three parallel groups of two motors in series; in addition, a further notch weakens the field for high-speed running.

The locomotive is arranged for regeneration on down grades, a special motor generator being installed to give a variable voltage for the excitation of the fields of the main motors. Three combinations are used for regenerating, six motors in series, four motors in series, and two groups of three motors in series, by which means a wide range of speed during regeneration is obtained; the line is mainly on gradients of from 1 to 2 per cent.

The main control gear is of the electro-pneumatic

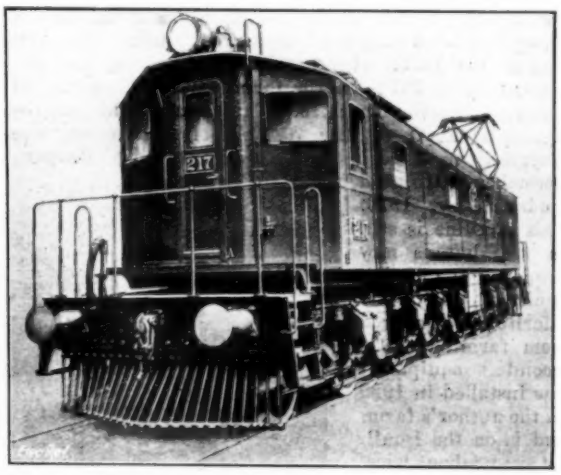


Fig. 2.—"Metrovick" Passenger Locomotive for the Paulista Railway, 100 tons, 2,340 h.p., 3,000 V. D.C.

type, the master contactors being operated by compressed air with electrically-controlled valves, the high pressure available making reliable contact between the switch members; operation can be successful even with greatly-reduced line voltage, and the control circuits of motors and accessories are operated at low voltage, thus increasing the safety of the driver and improving reliability. A fully-equipped driver's cab is provided at each end of the locomotive. The master controller is of the non-automatic drum type, fitted with three

handles, *viz.*, the main accelerating handle, the combined reverse and motor combination handle, and the regeneration handle, which operate three drums fitted on a common shaft. Mechanical interlocking devices ensure correct operation. The equipment includes another motor-generator set for supplying the low-pressure current for the control circuits and lighting and for the operation of the motor-driven compressor and exhauster. A 48-cell battery, charged from the motor generator, provides head, signal, and cab lighting when the high-pressure line is "dead," or when the locomotive is not in operation and it is not desired to run the motor-generator set for lighting only. Provision has been made for applying vacuum brakes on the train and compressed-air brakes on the locomotive; ordinarily, the locomotive brakes are applied automatically with the train brakes and with a proportional force, but provision has been made for partial application of the train brakes alone while regenerating.

The equipment is similar in many respects to that of the ninety-five 3,000-volt locomotives supplied by the Metropolitan-Vickers Electrical Co. for service on the South African railways, but, while the latter locomotives are of 1,200 h.p. each and are arranged for multiple-unit control, the much broader gauge of the Paulista railway makes possible the use of a much more powerful unit for single operation. The Paulista locomotive will haul a 400-ton train at 50 miles per hour on the level, at 48 miles per hour on a grade of 1 per cent., and at 39 miles per hour up a 2 per cent. grade, and it will be capable of negotiating curves of 300 metres radius.

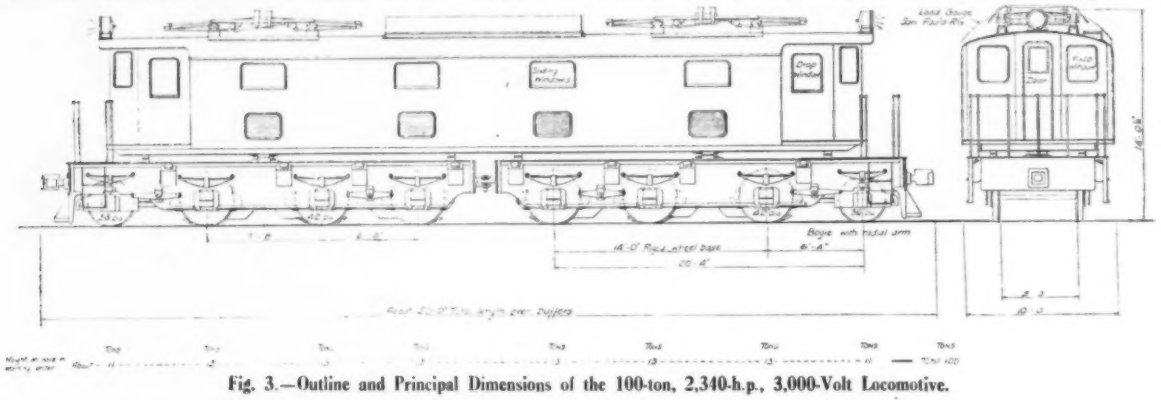


Fig. 3.—Outline and Principal Dimensions of the 100-ton, 2,340-h.p., 3,000-Volt Locomotive.

Electro-Farming.

A New Type of Tractor for Electric Ploughing.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

UP to the present, only three equipments for electric ploughing have been used in Great Britain. The first was on the double-winder wire-rope system, and was started up in 1910, on the farm of Mr. Chorlton, at Cotgrave, Nottinghamshire. This plant, which was designed by E. O. Walker & Co., of Manchester, was described in the columns of the ELECTRICAL REVIEW, December, 1915, and February, 1916. This machine is still in use, but is now employed for timber hauling, as Mr. Chorlton has retired from farming. The second equipment was installed in 1922 on the author's farm, and is on the Douillet roundabout wire-rope system, with a single haulage, and anchor pulleys carrying the rope round the corners of the field. The third equipment is due to Major A. McDowall, a Scots farmer, who, in spite of the fact that he has not had the advantage of an engineering training, has produced a most creditable tractor involving several new principles. The machine, which is the first plant designed for electric ploughing in Scotland, is suitable for cultivating, harrowing, and other field operations in addition to ploughing. As this machine seemed to promise well on paper, the writer made a special trip to Scotland to see it in operation when it was eventually constructed. The equipment certainly merits being placed on record. The most important feature of the design is the method of dealing with the flexible cable. This will probably be very carefully considered in future by electric tractor plough designers, since it entirely prevents the dragging of the flexible cable on the ground, with the consequent rapid depreciation of the cable. The flexible cable is divided into two sections, which may be described as the feeding cable and the tractor cable.

Fig. 1.—A New Electric Plough Tractor.

In conjunction with the tractor itself, a special cable trolley or a portable pole is used, which runs along a line at right angles to the furrows and halfway along them. A drum on this trolley carries the feeding cable which comes across the field from the farm distribution line. Each time the tractor passes the trolley, a bow-shaped projection carrying inclined planes on the former pushes on a horizontal wheel on the latter, and the trolley moves back a distance equal to the width of the furrows ploughed at each journey. A belt drive from one of the wheels of the trolley winds up the cable on

the drum at the same time, and as the feeder cable passes through an eye on the tiller arm of the trolley steering wheel, the trolley takes its direction from the line of the feeder cable and automatically steers along it. The inner end of the feeding cable is connected to three slip-rings on the drum, and the brushes running on these are connected to the outer end of the tractor cable. To avoid strain on the latter connections there is a mast on the trolley, to the top of which the tractor cable is clamped.

Since the current is fed from a point about halfway along the furrow, the tractor cable need only be about half the length of the furrow, a usual length for the cable being 200 yards. It is desirable that the drum carrying the tractor cable should, when winding in on the return journey, travel in exactly the same line as when paying out. The drum is therefore mounted on a transverse angle-iron track, and when the tractor passes the feeder trolley about the middle of a furrow, a latchet is pressed, which causes the drum to travel on its track a distance equal to the width of the furrows ploughed. This transverse movement also disengages the dog clutch which drives the drum. Hence, as the tractor proceeds, the drum simply rotates as a free wheel, the pull of the cable causing its revolution. When the headland is reached and, as later described, the tractor is side-stepped into its new alignment for the return journey, the drum is held stationary; consequently, the side-step movement of the tractor causes the driving dog clutch to again engage, and the drum being now driven, has on the return to wind up its cable until the feeder trolley is reached. At that point, this simple cycle of operation is repeated.

An automatic cable-laying mechanism is fitted to this drum, so that the cable is wound on evenly.

The drive and the greater part of the weight of the tractor are taken by a single full creeper track which runs on the unploughed land. The creeper track consists of a wide rubber-covered fabric belt, which is very flexible and wet-proof. The outside surface is armoured with hard aeroplane-steel wire to take the high-tension stresses and to protect it against wear, while transverse steel strakes are fitted to assist in getting a grip on soft ground. The weight of the machine is distributed over the belt by several rollers. In this way the pressure per square foot on the land is reduced to a small figure. This is the great desideratum in ploughing tractors, since it avoids packing the land and avoids the formation of any pan underneath.

The third point of support of the chassis is a wheel driven through a variable gear and situated on the flank of the machine. This wheel is used as a balance or steering wheel as follows:—The tractor is loaded and the variable driven balance wheel is normally speeded to run in a straight line, but circumstances arise which cause the tractor to deviate from its course. To rectify this, it is necessary to create a counter tendency—this is easily done by speeding up or retarding the balance or steering wheel. This principle can be equally well used in either direction of travel, and is therefore very suitable. It is well to remember that practically all land cultivation is carried out in straight lines. As cable winding and unwinding is a simple business, if straight-line work is adhered to, but full of difficulties when rectangular work or even curved-line work is encountered, the importance of adopting the McDowall system of feeding, where curves and rectangles are completely eliminated, becomes clearly manifest.

The motor is of 20 h.p., 400 volts, three phase, and the main drive is by a stage of worm-reduction gear followed by chains.

The tractor is of the reversible type, which travels to and fro without turning at the headlands. (This considerably reduces the headland space necessary.) Hinged ploughs or other implements are intended to be attached at each end, one set being lifted out of the way while the other is working. A notable feature of the design is that when a headland is reached, the machine lifts and transports itself sideways to the correct position for starting the next journey by means of a special double crankshaft action. This action was found imperfect in the first model, and a better gear has now been devised.

In starting a field, the auxiliary cable is connected to the farm distribution line, and the cable trolley and tractor are taken to the side of the field furthest from the supply. The tractor cable is then connected up to the trolley, and the tractor can start operations by travelling from the centre of the field to one end, both ploughs being raised. It then drops the required plough and returns, winding up the cable in the same line as it was paid out. Arrived at the centre, the drum is traversed into its new alignment; this movement automatically frees it from the driving dog clutch, and as the tractor proceeds, the cable is freely unwound. At the other end of the field, the whole tractor is moved into its new position and reversed. During this side movement, the tractor cable drum remains in the same position in space. In other words, it slides back to the other end of its rails, and the driving clutch again attends to winding-in duties. The driving clutch has a slipping device incorporated, and always overwinds, so that no cable slack ever occurs; at the same time, the slipping device makes certain that the cable has never a pull of more than a few pounds to contend with, and thus the life of the cable is greatly preserved. Before starting the return furrow, one plough is raised and the other is lowered.

At each journey the cable trolley is pushed back the correct distance, and the series of operations is repeated for each trip. The movements are practically automatic, and it is claimed that the equipment could easily be operated by an average ploughman. In fact, the constructor's stunt, in demonstrating it to laymen, was to make the whole machine "dance" by rapidly moving the controller reverse to and fro. This may not have been good for the motor, but it certainly showed to the man-in-the-street how very flexible and controllable is an electric drive.

A number of demonstrations of the plant have been given before various Government and other officials, who were greatly impresed by the ease of manœuvring. The machine performed well in mossy and boggy ground, the compression of the soil being very slight.

It is interesting to note that the whole tractor was constructed by Major McDowall in his farm workshop, with the help of one mechanic, and the result manifests undoubted perseverance and ingenuity. From experience gained in the operation of the first model, Major McDowall is now, with the aid of technical experts, designing an improved type.

As a practical farmer, he fully appreciates the necessity of cheap ploughing to the farmer, coupled with fool-proof control. To this he adds the perception that the electric way is the only way. He has shown wonderful perseverance in trying to arouse the interest of stony-hearted Government officials and of the somewhat indifferent members of committees of scientific bodies—incidentally he has done a lot of good to the cause of electricity in so doing, for it is proverbial that the continual dropping of water wears away the stone.

Government Competition in Australia.—At the recent annual meeting of the English Electric Co. of Australia, reference was made to the contract for electrical machinery awarded to the Government works at Cockatoo Dock instead of to a private concern. The company was one of those which submitted tenders, and the chairman (Mr. J. B. Nicholson) said that its tender was lowest in price and most efficient; and its Australian plant had given excellent service for 20 years. The company's alternative tender for "Australian made" plant offered the highest proportion of Australian equipment (96 per cent.). The company was face to face with the very serious competition introduced by the Federal Government, which offered on the one hand insufficient protection against imported products and cheap labour, while on the other it obliged the company to pay taxes while it fought the company with heavily-subsidised machine shops. That subsidy took the form of an extremely low rate of interest upon the capital expended upon the works. That policy might be compared with that of the British Government which guaranteed full interest upon capital raised by engineering firms in Great Britain (which were also the company's competitors) to enable them to increase their export business.

The Electricity (Supply) Bill.

A Suggestion by "OHM."

A PROVISION in the Electricity (Supply) Bill which has met with much objection is the one requiring the owners of selected stations to sell their whole output to the Central Board, with the right of re-purchase either at the sale price plus a proportion of the Board's expenses, or at the tariff fixed by the Board, whichever may be the lower. Those conversant with the reasons why large-sized sets, increased output, and improved load and power factors must of necessity result in a lower average cost, are well aware of the hope that the tariff will always be the lower.

Experience has something more to teach than merely to point out mistakes to avoid; it also teaches the elements of such success as has been obtained. It is from the belief that some of these elements have been ignored that much of the opposition has arisen. The popularity of electricity has not, like Jonah's gourd, grown in a night; from the beginning great difficulties have been met, and only overcome after long delay. The first fence was the inherent conservatism of the Briton, who has no desire to change just for the purpose of having new experience. There were some, however, who were endowed with prevision, and from the incorporation of the first power company in 1900, if not before, there were a few who saw something of the possibilities, though even they had no conception of what has since been accomplished—much less of what is yet to come.

The rates which the power supplier could offer were often lower than the cost of supply to the consumer as determined by the supply engineer, but not lower than the cost which the power user himself believed he could generate at. In comparing the terms, the power user said: "I have written off the cost of my steam engine long ago, and unless you can show me that your charges added to the cost of converting to electricity are less than the cost of coal, repairs, wages, and other expenses, without including any capital charges at all—well, there's nothing doing." The result was that progress was very slow. There were some power users whose plant was so inefficient that even these unequal conditions of comparison showed a saving. There were others whose plant was worn out, and whether they liked it or not, they had to include new capital charges when comparing their costs with the tariffs offered. There were some who saw no immediate saving but believed in the future; they were of the elect, and the engineer of those early days has not yet forgotten to be grateful for their confidence.

There was a growing demand for lighting and domestic uses, but putting them all together they were only a tithe of the requirements of to-day. Progress was sure but very slow, and the difficulties were increased because power companies could attract little new capital through their inability to pay any return on the capital already subscribed by those whose faith had been greater than their reward. Then came the war and all was changed. Enormous demands were immediately created, and the saving of time was vital; these demands could be most quickly met by an extension of mains and by the installation of electric motors wherever there was a roof to keep them dry. Economy was of no importance; freedom must be retained whatever the cost, the bill could be dealt with when liberty was once more secure.

The war ended, and the rapid development of electricity supply seemed to offer one of the most attractive means by which pre-war conditions could be restored; and as, under the duress of war, the Briton, loving liberty beyond aught else, had willingly submitted himself to galling conditions of restraint, there were some who thought that compulsory joint electricity authorities would be accepted without question.

The influence of war psychology has not yet entirely disappeared, and the Electricity (Supply) Bill has to many the appearance of an electrical "Dora" carried over into the days of peace when other folks are looking round for valid grounds for divorce. Whatever the hopes may be, pre-war psychology will reappear, for human nature, British human nature particularly, hates compulsion.

The building-up of the consumption of electricity to the ideal of 500 kWh per head—which, by the way, is five times the consumption of the year with which the ideal is compared—will only be gradual. It will be more rapid than before the war, but it will be gradual. The conditions of trade, the limited capital—for capital is required for many other purposes besides electrical development—the reluctance to scrap plant which is doing good service, and many other reasons will make it a gradual process.

The objections are not made to those proposals which the ignorant would readily accept as an absurdity, but in the belief that the 500 kWh per head of population will not arrive so soon as is assumed, and that in the meantime the cost of production will be increased. Can these fears be allayed by proceeding on different lines? Is it necessary to assume that authorised undertakers must be made to increase their output by the hand of authority? Is it necessary that the whole of the "grid" should be owned by a new authority to be created by the Bill?

Under the present proposals the duplication of mains seems unavoidable, for instead of requiring authorised undertakers to use existing mains for linking up, it is proposed that an independent body should do this, even though it may bring about conflicting aims.

It may be answered that the Bill provides that mains already laid will be acquired in so far as they can be incorporated in the grid. Quite so, but has it been ascertained how many transmission mains there are which are not "an essential part of an authorised undertaker's distribution system or the distribution system of a railway company or the owners of a dock undertaking"? Very few, if any, because authorised undertakers have not considered themselves economically justified in laying any mains other than those which are essential to their distribution system.

Why should selected stations only be linked up? Let all stations within one or more economically grouped electricity districts be linked together. If this is done, the authority who believes that his autonomy will be destroyed by the Bill will have less reason for that belief and when, in the fullness of time, bulk supply is found to be cheaper than independent generation, the generating station can become a point of distribution, and local pride will still not need to be denied. Much has already been done in this direction, and there will be continuity of progress on lines which have already proved successful.

Why should new stations in the area of an authorised undertaker be owned by a new authority? and why should selected stations be altered or enlarged under penalty of taking over? There is no difficulty in getting authorised undertakers to erect new stations. The difficulty is to choose between those which strive for the honour.

Why should stations be operated by an outside authority? Cannot committees be formed by those who are locally interested to arrange for mutual operation which shall help all, instead of running the risk of aiding one at the expense of another? It is by such means that a healthy rivalry may be created, which, based on the advice and assistance of the Commissioners, would do much to extend success already secured. Let the mains in the area of an authorised undertaker be owned by that undertaker, and if there is more than one undertaker authorised to supply, let user be a guide to ownership. If, to fall in with the general scheme of the Commissioners, the mains are larger than would be required for the immediate purposes of the authorised

undertaker, then some help may be given out of the general fund until the mains pay for themselves.

Mains will be required in areas where there is now no authorised undertaker. These could be constructed out of moneys received from the issue of Central Electricity Stock, and interest and sinking-fund charges would be paid out of a general fund charged upon all undertakers. Should an authorised undertaker appear later, then arrangements might be made for it to take the mains over on satisfactory guarantees being given. The mains outside the areas of authorised undertakers would be laid with due regard to economy and a proper return upon the expenditure. At first there would be loss, but the reduction of the charges would become an object of the whole industry, in which local authorities and companies could combine; it would be to the interest of all that the mains should be remunerative with the least delay.

Difference of opinion would arise, but then the man who doesn't dispute usually doesn't care. Out of these disputes, unless they are merely factious opposition, a friendly rivalry arises which brings success. There may be factious opposition, but probably not so much as might be supposed. If people do not seem willing to be reasonable, let them appear before an independent tribunal. They will indeed deserve success if their case is better than that of the Commission with all its experience and resource. Appeals will be rare and will tend to become rarer, as out of the paths to be chosen one will persistently present itself as that which leads to true development.

These are but the thoughts of a single Ohm for which none need take responsibility, but referring generally to the Ohms who are resisting the Bill, whilst it is true that an ohm is a measure of resistance, it is not an agency of destruction. Rather is it a measure of that power which acts in opposition to the impulse of another; in other words, that which prevents the amperes from straying into paths where their usefulness may be destroyed; that which guides them where the greatest unity of effort may be found, where the representatives of local authorities and companies may work together.

To foster unity for the good of all is better than to proceed on the principle *divide et impera*.

The Revival of an Old Tariff.

By ERNEST E. SHARP, A.M.I.E.E.

MULTI-PART tariffs in this country have so far tended to be two-part only, but the valuable paper that Professor Parker Smith has given at the Institution of Electrical Engineers and its local Centres points to the fact that although the rateable value system (as an instance) meets a good deal of the tariff requirements of the domestic consumer, it does not go far enough to cover the special case of water-heating during the night hours. In his particular case, the Glasgow Corporation has added the two-rate system to cover this need.

During the last year or so I have found in conversation with supply engineer-managers both at home and in many countries abroad that the two-rate system is being more and more forced on their attention by the need for a system that will (1) apply equally to all classes of supply, (2) ensure consumers paying a higher price for current used during the *station* peak (not necessarily at the same time as the consumers' peak), and (3) offer inducements for off-peak business at remunerative rates.

(1) There is no gainsaying the fact that much argument occurs and much dissatisfaction is caused by the differences in charges that commonly occur between different classes of consumers. The big manufacturer paying 1½d. per kWh cannot understand why a small householder pays only 1d. The latter finds no difference in quality between his twopenny heating units and his penny cooking ones, and is inclined to argue with the supplier as to whether a thermo-siphon refrigerator is heating or cooking! And the shopkeeper, seeing the light over the cooker, is quite willing to try the "cooking-quality electricity" for his shop-window. The two-rate system can be applied universally to all these classes of consumer.

(2) It is not necessary to go over the old ground of maximum demand and diversity factor. It is sufficient to point out that the latter became a necessity to qualify the rigour of the former, and is often a matter of guesswork; or shall we say a convenient means of squaring expediency with equity? The argument, of course, is that so long as the M.D.'s do not all coincide, they are not so serious to the station as they might be. It is equally obvious that no matter what the diversity factors of the different classes of load may be, there is some time in the day when there is such overlapping as to cause a peak. This may be in the morning in one town, the afternoon in another, and the evening in a third. The two-rate system is equally applicable under all these conditions, ensuring the proper price being paid for peak time energy no matter at what time of day the peak may be. As conditions change, as they are almost certain to do in the next few years, this system of charging still retains all its good points, still ensues peak time costs being covered, no matter when the peak occurs in the 24 hours.

(3) Conversely, the hours of charging at the low rate may be altered to give every inducement to consumers to build up the valleys in the load curve. It is not necessary that there should be *one* consecutive period of high charge, followed by *one* consecutive period of low charge. Two switchings on to high- and two to low-rate, at least, can be arranged for, if desired, in every 24 hours, and the same switch that operates the meter can also switch water-heating or other circuits on or off at the same time, if required.

In fact, the two-rate appears to be such a clear and simple way of avoiding a multiplicity of tariffs and their sometimes involved justifications that it is only reasonable to ask why this system—which is a very old one—is not more widely used, and why in several cases it was discarded many years ago.

I think the explanation lies in the fact that it was before its time. To install a more expensive meter and a time switch on a purely lighting job, as was commonly done in the early days, meant a very high capital outlay on a service that could not produce a sufficient revenue to warrant it. Moreover, light being the one thing that *must* be used at certain hours, no amount of inducement in tariff could divert any of this load to off-peak hours; and, except for factories, there was nothing else but light to sell. One other crushing point was the unreliability of the instruments in those long-ago days.

Now, however, the whole situation is altered. There is no difficulty about the instruments; the capital outlay is proportionately less, having regard to the different money values; and most important of all, there are so many "other uses" that can be cultivated and the revenue can therefore be so much more.

I will not labour the point except to say that I have for years been an admirer of multi-part tariffs such as the rateable value, floor area, &c., type; but I think most engineers realise their limitations, and I know that in my own case I have found the need, as Dr. Parker Smith has done, for something beyond this, and I believe that he and the Glasgow Corporation have solved the problem in the right way, by the adoption of the simplest of all systems—the two-rate.

Economics and the Engineer.

By HARRISON DENT.

AT this moment there are thousands of engineering students "swotting" laboriously in the numerous colleges of Great Britain for B.Sc. finals and other examinations. The young engineer's training is probably the hardest of any professional education, and the variety of subjects covered is large enough already. Yet one feels that he needs another addition to his mental equipment—the much-neglected study of economics.

The experience of engineers who have been confronted with all kinds of jobs suggests a need for some commercial knowledge, for as the technical man moves upward from post to post he often finds less technology and more commercial or organising ability is needed.

An engineering training cannot be expected to cover a wide commercial field, but its duration is either three or four years, and it is during the last year that space might be found for the study of economics. It should be feasible to cut down a four years' preparation for the B.Sc. Engineering Final, and to institute a post-graduate course of, say, six months, covering those subjects, outside pure technology, which are nevertheless essential to the engineer's full development.

We have long been acquainted with the purely commercial man's criticism of the engineer as uncommercial and ultra-technical. While this may be in many instances justifiable, the engineer's retort that the commercial man lacks fundamental principles and sound methods of deduction and analysis may be equally true.

Under present industrial conditions many engineers are turning to commercial work in order to fit themselves for high executive positions.

It would be much better for the engineer if he received a grounding in economics, the widespread science of how men and nations live, before he entered into industry. His training suits him for the ready grasp of economic principles. Without them he is in danger of seeing only the technical side of a problem and of missing the wider issues.

Economics may, perhaps, humble the engineer's pride in being an engineer, for it must show him that the first essential to industry is a market and a salesman. Without these things the engineer who designs, or who manufactures, cannot exist. So many technical men are inclined to put the cart before the horse, and consider an engineer to be the primary essential, that the dawn of economic understanding should correct this slight distortion of mental vision.

Both engineer and salesman are necessary, since neither can exist without the other, and both need a grasp of economic fundamentals. The writer believes that economics and civics should be taught not only in engineering colleges, but in all schools. In the future this must take place, and the substitution of principles for bare facts will extend outside the engineer's domain.

One of the commonest experiences of a young engineer in industry is that of coming up against a question of costs. His training says nothing about costs, and here is a "mere salesman" arguing that this perfect engineering proposition (the perfection of which he is ignorant) is not a commercial job and must be revised! The salesman is right. The market, the selling price, and the commercial cost come first.

The design must be revised, and it is the voice of Economics herself which demands the revision.

Someone will remark that the salesman has not studied economics either! Probably so, but he is experienced in the questions of buying and selling which are part of economics, whatever name you give them.

The subject is a wide one to survey in a short article, but its salient features are features of every-day existence. Wealth, value, labour, the meaning of these abstract things which we so often take for granted: supply and demand, marginal increment, market saturation, the business cycle, the laws of which operate inexorably; rates of exchange, customs barriers, trusts and cartels, purchasing power parity, the meaning and effect of these things on industry and the individual—surely the engineer, with his cultivated passion for fundamentals, wants to get down to bedrock on such problems. The study of economics gives just that breadth of outlook and understanding which a technical training may tend to narrow. Not that one wishes to decry the engineer's training; no one will contest that it is one of the most valuable assets any man can have, whether he is to become an engineer or not.

These contentions are brightly illuminated by world industrial conditions to-day. Great Britain, faced by the problems of labour unrest, the coal deadlock, underselling by nations producing cheaply with depreciated currencies, the competition of the United States, with her intensive market cultivation and her production efficiency, and the reduced purchasing capacity of other nations, needs men of economic understanding to solve her difficulties and fortify her world trading position.

The pure research engineer may consider such questions outside his scope, but to the industrial engineer they are vital issues which he must grasp and help to solve.

It is a truism that the reactions of economic disturbances are world-wide. The failure of an American cotton crop breaks like a bomb on the men of Lancashire 4,000 miles away; the discovery of a rich lead mine in Canada may lighten the heart of a cable maker in London and cast gloom on a producer in Mexico. In this way economics forces us to think outside narrow lines and to see every individual as an interdependent link in a world chain; to realise the folly of customs barriers that are citadels of economic warfare; to understand the common sense of co-operative marketing wherein all benefit; to condemn the antagonism of labour, administration and capital, which are hand, brain, and means to a common end.

What has this to do with the engineer?

In modern industry he rises to high positions on the executive side where these questions enter and ask for a decision.

Hence this plea for the entry of economics into the engineer's training. How far such an idea can be developed concerns those at the head of the engineering industry and of the technical educational world.

The principals of the engineering colleges know best how much can be accomplished in this direction, and it would be of interest to see them in conference with the professors of the London School of Economics and the directors of large engineering concerns on the broader education of the student-engineer.

The Shannon Scheme.—At the twenty-second annual Congress of the Irish Technical Instruction Association, held at Killarney, on June 22nd, the Shannon scheme was referred to in a paper on "Some Avenues of Progress," read by Mr. George Fletcher, F.G.S., in which it was pointed out that the undertaking would not only encourage the development of existing native industries, but would also attract many new ones. The author referred to the essential connection between technical education and industrial prosperity, and added that the lack of industries had been a serious obstacle to the teaching of technology in the Free State.

At the twenty-third annual general meeting of the Cork Industrial Development Association held in Cork on June 22nd, Senator J. C. Dowdall, moving the adoption of the annual report, referred to the Shannon scheme, and said: "The Shannon Scheme will be sterile if industries of some sort are not in existence to utilise the energy it generates. Our efforts should be directed to establishing these industries in good time. Broadly speaking, the Irish Free State exports are raw materials, people, and cash; and the imports, manufactured goods."

The Electrical Contractors' Convention.—I.

Successful Gatherings at Brighton.

THE first annual conference of the E.C.A. Allied Associations— to borrow the title of the official programme— was so successful in every way that members, including those who were unable to be present owing to the coal trade dispute, must already be looking forward to the second gathering with full assurance that at Scarborough next year there will be a much larger attendance because of the popularity, enjoyment, and general achievements of June 23rd-26th, 1926.

Including members, their wives and daughters, and a number of non-contractor visitors, the Brighton attendance was 360 strong. The true convention spirit was evident everywhere. The Conference Hall at the Royal Pavilion was crowded during the reading of the presidential address by Mr. T. E. Alger; the audiences were not much reduced during the reading and discussion of papers, or at the annual general meeting; and though the weather managed to occasion some slight inconvenience, the social side of the proceedings was as pleasurable as it was well organised. Mr. H. J. Galliers, the Conference Secretary, was mainly responsible for the success of this side of the function.

The reception by the president took place on the evening of Wednesday, and at once there was introduced that atmosphere in which there seemed to be perfect freedom for fraternisation between old acquaintances and for the forming of new friendships. Electrical contractors will know each other better all the year as the result of these days spent together in the general body; so far, each man has known his own local group—now he knows many others, and the spirit of comradeship and exchange of ideas and experiences will be encouraged thereby. There was nowhere any very marked suggestion that the electrical contracting business was in a bad way—indeed, if any evidence predominated, it suggested virility, confidence, and optimism.

So far as the general affairs of the Association were concerned, the mind of the Conference was unanimous in its appreciation of the untiring efforts of the president, Mr. T. E. Alger, during his year of office, and the capacity which he had shown for handling with tact and judgment the many matters of importance that have had to be dealt with during that period—a period rendered the more strenuous and difficult because of the death of "our old friend Tate," the secretary. Another thing that the meeting approved with equal unanimity was the generous manner in which the widow and family of the late Mr. Tate have been provided for by the Council. It was most satisfactory, too, to hear the approving applause which greeted the references to the appointment of the former assistant secretary, Mr. L. C. Penwill, as secretary of the Association. That gentleman has already proved beyond question that he possesses the necessary experience and other qualifications, and as his duties will shortly involve periodical visits to the branches in different parts of the country, the decision to appoint an assistant is a wise one, for though there may be signs that there will be less strenuousness in respect of Parliamentary militancy in the near future, the year will call for much watchfulness over such matters, and the other activities of the E.C.A. and its associated organisations will not grow less.

We commence below a summary of the proceedings at the Conference and, while offering our congratulations to Mr. Alger on a very successful year's achievements and on being the president of the first Convention, we also extend a welcome to Mr. H. J. Miles, the new president, and hope that during his occupation of the chair he will witness a great advance in the movement for ensuring fuller genuine co-operation between the contracting and other interests of the electrical industry, as well as a considerable increase in the Association membership.

A notable feature of the gathering was the large number of ladies present, and a committee of ladies of the Sussex Branch of the Association was in attendance at the Royal Pavilion to entertain lady guests who did not desire to attend the whole of the meetings.

During the conference the exterior of the Royal Pavilion was illuminated at night by flood lighting, for which the General Electric Co., Ltd., was responsible, in collaboration with Mr. J. Christie, the Borough Electrical Engineer.

The president's reception on June 23rd took place in the Music Room and King's Apartments of the Royal Pavilion. Flowers were provided for the ladies on this occasion by the British Thomson-Houston Co., Ltd.

Before the business of the Conference commenced on June 24th, a civic welcome was accorded the delegates and visitors by the Mayor of Brighton (Councillor J. Lord Thompson, J.P.), who was accompanied by the Mayoress. Mr. H. L. Smith (chairman of the Sussex Branch) also extended a welcome.

The Mayor, in his welcoming speech, paid a tribute to Councillor H. J. Galliers (conference hon. secretary and treasurer) and said that he was a very active member of the Town Council and of the Lighting Committee. The questions which the Conference would discuss were of interest not only to the Association but to the public at large.

The Presidential Address.

IN the course of his address, the president, Mr. T. E. ALGER, reminded the delegates that the E.C.A. was the oldest trade organisation in the British electrical industry, and that other sections of the industry had followed its lead and organised themselves upon similar lines. In twenty-five years electricity had developed from a somewhat costly novelty to be enjoyed by a few, into a necessity demanded by the million, and the whole industry had largely developed within the same brief period of time. The number of applications for electricity supply powers that came forward in the few years immediately preceding the year 1900, prompted the formation of contractors' organisations in many localities, because prospective developments appeared to threaten the very existence of private electrical contractors; but even then the contractor's programme was definitely constructive in character. The aim was the general development and improvement of the whole trade and those and similar ideals had been in the forefront of E.C.A. policy for the past twenty-five years. No opportunity had been lost to open up helpful negotiations with other sections of the industry.

Reverting to the early history of the organisation, Mr. ALGER said that a meeting was held in London in February, 1901, under the chairmanship of Mr. H. Alabaster, of the ELECTRICAL REVIEW. That meeting was attended by contractors from London and a large number of provincial centres, and it was decided there and then to form a "National Electrical Contractors' Association." In January, 1902, the organisation was definitely established, with Mr. W. R. Rawlings as first president. It was in the same year that their lamented friend, Mr. L. G. Tate, joined the organisation, and he remained connected with the Association until his untimely death, which came as a most profound shock to their entire membership. The first meeting of the old National Association, held in April, 1902, discussed the possibility of arranging trading agreements between manufacturers and contractors, and it was as a direct consequence of these discussions that various manufacturers shortly afterwards formed themselves into the "National Electrical Manufacturers' Association"—the direct forebear of the B.E.A.M.A. In 1904 the Board of Trade granted a licence to "The Electrical Contractors' Association (Incorporated)." That licence debarred the Association from entering into negotiations with trade unions or from sharing out any dividends or bonuses that might accrue, and those restrictions seriously hampered the work of the incorporated body. Accordingly, in September, 1915, a committee was formed to discuss the promotion of two additional organisations:—(1) A limited company that would take over such work as the E.C.A. was doing, which was more to the advantage of individual members than to the benefit of the trade generally—such as trading agreements with manufacturers and so on; and (2) A national association to deal with all labour questions. In 1916, application was made to, and granted by the Board of Trade, for the incorporation of the N.E.C.T.A., Ltd., and at the same time the National Federated Electrical Association was formed as an unregistered trade union. In 1917, the latter association was duly registered as a trade union under the Trades Union Act of 1913. The work of the three associations was now divided as follows:—All legal, parliamentary and Government work was carried on by the Electrical Contractors' Association (Incorporated) which was represented on the councils of technical institutions throughout the country and looked after and protected the interests of electrical contractors generally; the N.E.C.T.A., Ltd., dealt with the "trading policy" of the Association; while the National Federated Electrical Association dealt with the regulation of labour matters on a national basis. The business of the three associations was conducted by a central council.

Turning to the National Register of Electrical Installation Contractors, Mr. Alger said that it was destined to play an important part in raising the professional status of installation engineers. They looked forward to the time when registration would be compulsory and work carried out by registered contractors would be executed to a definite code of rules. In those two directions substantial progress had yet to be made. The best way to strengthen the organisation was for every eligible contractor forthwith to associate himself with the movement. The N.R.E.I.C. was designed essentially to consolidate the *professional* status of the installation engineer. To secure his *commercial* security, membership of the E.C.A. Allied Associations was of paramount importance to every reputable contractor.

Mr. Alger then indicated the scope of some of the papers which were to be read, and then stressed the fact that the E.C.A. was not solely a fighting organisation. The principal aim of the organisation had been to secure progress by negotiation. There was an ever-growing spirit of co-operative amity developing throughout the industry. The need of the hour was reconstruction with the one idea of general trade prosperity in mind. The E.C.A. Trading Committee laboured unceasingly to develop and smooth the relations existing between the manufacturer and reputable wholesaler and the re-seller members of the organisation. They were justly proud of their "trading policy," which constituted the only electrical guide to sane trading that existed in the industry. In other directions the main publications of the Allied Associations were wholly educational. The publishing activities of the Allied Associations represented no small achievement in themselves and reflected the active, progressive spirit that animated their entire organisation. In conclusion, the president said that it was his firm belief that we were on the eve of a period of prosperity in this country and he hoped that their first conference would prove to be a good omen for the future prosperity of the electrical industry in general and for each and every member of the E.C.A. in particular.

Annual General Meeting.

THE annual report for the year 1925-26 was presented by the President after he had delivered his address. Mr. Alger again referred to the death of Mr. L. G. Tate, and said that in recognition of his able services the Association had made generous provision for his wife and family. The past year had been full of activity of an exceptional nature, and exceptional demands had been made upon the Council and committees. Mr. Kennedy had been appointed wholetime editor of *The Electrical Contractor*. On the death of Mr. Tate, the assistant secretary was appointed acting secretary, and in due course, the Council appointed Mr. Penwill as secretary, and it had been decided to appoint an assistant to Mr. Penwill. During the past twelve months the Association had been active in opposing those whose main policy appeared to be based on the need to belittle private enterprise and to place many important trades and industries under bureaucratic control. In this work they had at least been successful in opening the eyes of Parliament and other important bodies to a great and growing evil. They had accordingly arranged a compromise with the I.M.E.A., which was not only in keeping with the spirit of the times but which they believed would be to the lasting benefit of the whole electrical trade and industry in this country. They had agreed a clause for insertion in all Parliamentary Bills seeking trading powers. This agreed clause would also be put forward by the I.M.E.A. as an amendment to the Electricity Bill now before Parliament in substitution for the amendment at present standing in the name of the I.M.E.A., which was the old L.C.C. clause.

The most important feature of the compromise was the committee which must be set up to deal with all points in dispute between local authorities and members of the electrical trade. That committee would include municipal engineers and electrical contractors together with representatives of all kindred electrical associations. In that connection he acknowledged the services of Mr. W. Finlay, of the E.C.A. of Scotland, and those of Mr. Dunlop, of the B.E.A.M.A., who assisted greatly in bringing about, and conducting, the meetings which led up to the compromise. He also acknowledged the financial aid of the E.W.F. towards the expenses incurred in their Parliamentary work, and similar assistance received from the Sheffield Branch. With regard to the Association generally, there had been a steady increase in membership, but they would not be satisfied until all established contractors were members. The present conference was one of the many outward and visible signs of their ever-increasing strength and trade spirit. In this connection he acknowledged the services of Mr. H. J. Galliers, conference secretary, who, in conjunction with Mr. Miles, had made all the arrangements. The balance sheet showed that the year had been a period of extraordinary expenditure which would not recur. Apart from that expenditure the finances of the Association were sound. In that direction the thanks of the Association were due to Mr. W. H. Walton, who consented to act as chairman of the Finance Committee on the resignation of Mr. Wintle. No new trading agreements had been entered into during the past year, but it could be claimed that very substantial progress had been made in their relationships with other trading associations. The Trading Committee had devoted a very considerable amount of time to the investigation of complaints, and in the majority of instances, satisfactory solutions of difficult problems ensued.

So far as labour was concerned, the period under review, except for the General Strike, had been practically peaceful. With regard to the General Strike, however, the manner in which all rules and regulations were torn up could not be passed over lightly and would be the subject for serious consideration by the Council generally and by their Labour Committee in particular. He was hopeful that a satisfactory and lasting settlement of the coal dispute would be arrived at shortly. That accomplished, he believed that we were on the eve of a period of considerable prosperity for this country, and certainly for the electrical industry. Mr. H. J. Miles of Brighton, who had been elected president for the ensuing year, was too well known to need any introduction. Mr. Walton had been elected vice-president.

Mr. W. R. RAWLINGS (London), proposing the adoption of the report, paid a tribute to the officers and councillors for their work during the year, and endorsed the Council's action in appointing Mr. Kennedy editor of *The Electrical Contractor*. He deplored the untimely death of Mr. L. G. Tate, and recalled the efforts of Mr. Hogan, who was secretary in the early years of the Association. He said it was due to the president's untiring efforts that Mr. Penwill had been able to keep the work of the Association up-to-date. The president had spent week after week in London, devoting himself to the Association's affairs. Finally, Mr. Rawlings expressed gratitude to Councillor Galliers and Mr. H. J. Miles (the president-elect) for the way in which they had organised the conference.

Mr. F. H. STARLING (Nottingham) seconded the adoption of the report and endorsed Mr. Rawlings's remarks.

The PRESIDENT, in a brief response, said that for any efforts he had made on behalf of the Association he was amply repaid by the success of the conference. The report was then unanimously adopted.

The Accounts.

Mr. H. MARRYAT (hon. treasurer) presented the accounts, which showed a loss on the year's working amounting to £850. This deficit was attributable mainly to the heavy legal expenses borne during the year, which amounted to £2,617, and were quite abnormal.

Mr. J. ORRINGE (Leicester) proposed and Mr. W. A. BAXTER (Birmingham) seconded the adoption of the accounts.

In reply to Mr. Heywood (Rochdale) Mr. MARRYAT stated that during recent years the contributions to the funds of E.D.A. had been £400 per annum, but last year there had been an additional amount of £200, as the result of a special appeal. He felt that the Association should pull its weight in supporting the E.D.A. The Association's contribution during the current year would be £400.

Mr. H. F. SIMON (London) recommended that the subscription to E.D.A. should be increased to £1,000 per annum.

The PRESIDENT intimated that the Council would note the suggestion.

The accounts were approved.

Membership of the N.F.E.A.

Mr. W. A. SHAW (Stockport) proposed the re-election of members of the National Federated Electrical Association. During the year, as the result of bankruptcies and other factors, the Federation had lost a number of members, but on balance the membership had increased by 41. The total membership of the E.C.A. was now 797 full members, compared with 756 last year. There were also 78 "second" members.

Councillor GALLIERS seconded and the resolution was carried unanimously.

The question of a reduction in wages in the trade, in consequence of the decrease in the cost of living index figure, was raised by Mr. H. C. Hazel (Liverpool), but it was intimated that a meeting was to be held with the Electrical Trades Union on June 29th.

A vote of thanks to the president for his able conduct of the proceedings concluded the business of the annual general meeting.

Co-operation Between Electricity Suppliers and Contractors.

By W. FINLAY, W.S.—*Abstract.*

THE author, who is secretary and solicitor to the Electrical Contractors' Association of Scotland, stated that the electricity supply and contracting sections of the industry were in the closest touch with consumers. They were interdependent, not competitive, and neither should endeavour to encroach upon the other's business. The contractor was the first on the scene as a constructor of private installations and electricity had made considerable strides before supply authorities came into being. The earliest consumers of the latter were obtained by the unpaid canvassing of the contractors and the same might still be said of the present consumers. In earlier days many so-called "contractors" possessed but rudimentary knowledge, but year by year the contractor was becoming a highly-trained specialist. Every order secured by the contractor gave him temporary employment, but he brought to the supply authority a perpetual demand for electricity. If a large demand was to be obtained the authority must supply electricity at a moderate rate to justify the contractor in urging extended consumption. Low prices could only come through a reasonably continuous load and here there was scope for conference between the two sections to enable such a load to be secured. Although too sanguine hopes had been built up on the Government's electricity proposals, there was no doubt that given its proper chance electricity could do a great deal more for the country. The endeavour to introduce electricity to new consumers—domestic, commercial, and industrial—could be done in one or two ways. First the supply authority could attempt the work itself which was at present being done by contractors. It was

argued that that tended to cheapness but that was largely illusory, and, moreover, irreparable injury would be done to contractors who had established businesses during the past forty years. It would lead to a crude standardisation of work and restriction of choice, and there would be a tendency to give away installations and appliances merely to sell energy. The alternative was co-operation—the only statesmanlike solution and tactical basis for a forward movement. Good installation work and good salesmanship could only be obtained, whether by supply authority or contractor, by paying for the right men and the employment of proper materials. A supply authority's installation department could only cheapen installation work by burying its losses in the general accounts of the undertaking. A contractor would fight shy of co-operating with an authority which meditated engaging in his own business. He required an authority, with an efficient and cheap supply with an adaptable scale of charges. In the past the contractor had passed many customers on to the supply authority; therefore the latter should not complain that it was finding business for the contractor. Recently a supply engineer who maintained an installation department offered to pass on surplus orders to contractors at net cost plus 20 per cent. In addition that engineer retained an additional 15 per cent. merely for passing on the order. That was commercially unfair; it was making use of the contractor as a "stand-by supply" and forcing him to work at a minimum rate. Although that engineer claimed to have made a profit on installation work there was reason to believe that it was a paper profit only and that the general funds of the undertaking were standing the burden of eliminating the contractor. Each branch should stick to its own job and combine with the other for propaganda work in the common interest. In each supply district a regular conference between the two parties should be set up to work out means of co-operative development. Publicity work of all kinds could be carried out, for the supply authorities' records would enable both consumers and non-consumers to be ascertained with a view to providing each class with appropriate literature. The supply authority might even undertake to pay for installation work, recovering the cost from the tenant or landlord by instalments. Showrooms could be set up in areas where adequate private showrooms did not already exist, and where hiring was embarked upon it should be done on an economic basis. The authority would find that the installation work would be done better and cheaper by private enterprise. Another matter which could be attended to was the recognition of national regulations for installation work, by which "shoddy" contractors would be eliminated from the trade and registration would be made an essential condition of installation work. A monopoly had a strangling effect upon enterprise, whereas, under competition, every inventor who had anything worth developing would find some progressive contractor to take up and "push" his invention. Every manufacturer would get a fair share of business and the consumer would not be bound by the red-tape rules of a municipal wiring department. If the two branches of the industry would work together for the welfare of the industry as a whole, in an open and generous-minded way, we would live to see Britain in the van of electrical progress.

Discussion on Mr. Finlay's Paper.

Mr. J. W. BEAUCHAMP (director, Electrical Development Association) outlined briefly the combined campaign to be carried out during the coming winter by the E.D.A. and the E.L.M.A. (Electric Lamp Manufacturers' Association), to push domestic electrification throughout the country, which, he said, would depend for its business-getting success upon the extent to which the contractors supported it. The campaign, which would cost about £30,000, was called "Wiring the Homes of Britain." It was to be directed particularly to increasing and improving electric lighting in the home, to securing the more rapid connection of new premises, and generally to get a boost on the domestic side of the business. The usual amount available annually for the E.D.A. campaigns was about £20,000, but on this occasion the E.L.M.A. had thrown in its winter allocation, and had offered the invaluable services of Mr. Bush, its director, and his staff. From November to April display advertisements would be inserted in newspapers covering a reading circulation of 14 million persons, the cost of which would be nearly £20,000. The purpose of the advertisements would be to arouse public interest in the electric home, and particularly to make the public desirous of obtaining from contractors a book which was to be produced by the E.D.A. Copies of the book could be obtained from the Association by the contractors at cost price, to be handed to the public, and the contractors would obtain from those to whom they were distributed a coupon bearing their names and addresses. He urged the contractors to set up local committees for the purpose of running all-electric houses, and so on, during the campaign. By this scheme they would not be spending more money than usual on propaganda, but would be spending it in the one direction. The number of houses connected each year was between 20,000 and 25,000, and he believed that the campaign could double that figure within the next 18 months.

Mr. J. CHRISTIE (Borough Electrical Engineer, Brighton) indicated how co-operation had benefited the Brighton electricity undertaking. When he went to Brighton 26 years ago the annual output was something under 2,000,000 kWh, but the output this year was more than ten times that amount. It had been doubled within the last four years, and he saw no reason why should it not be doubled every fourth year in future. That success he attributed to the giving of a very efficient, reliable and cheap supply to the inhabitants, and also to the wholehearted co-operation of the contractors. The collection of its own revenue by the electricity undertaking was undoubtedly one of the best publicity factors. About 16 years ago he had managed to get the revenue collection transferred to his department, and, whereas previously bad debts had amounted to about £600 a year, whilst another £600 a year was paid to the authorities for collection, at the present time, with an annual income of about £200,000, or three times the previous income, the bad debts amounted to only about £150. The payment of the accounts over the counter brought the consumers into contact with the staff and the latest electrical appliances, which, in the ordinary way, they would not go into the contractors' showrooms to see. He hoped to persuade the Corporation to spend £30,000 or £40,000 on the provision of accommodation for revenue collection and a first-class showroom. The contractors would be able to use it as their showroom and to introduce their clients there. He advocated hire-purchase rather than free wiring. There was nothing free in this world, and free wiring was the most expensive form of wiring. He suggested that the E.C.A., the I.M.E.A., and kindred associations, should appoint a small committee to discuss the matter. We wanted a few "Drages" in the business. When equipment was hired there was always a small percentage of consumers who would abuse it, simply because it belonged to the supply authority, and that small percentage did more damage to the undertaking than anything else. The rentals were swallowed up in the re-conditioning of the apparatus returned. He urged the introduction of electric cooking into secondary schools. Great advantage had also been derived from electrical exhibitions in Brighton, in which the contractors and manufacturers had co-operated heartily with him.

Mr. R. ROBSON (Newcastle-on-Tyne) said that since its formation in 1900 the Newcastle Branch had been working in close co-operation with the Newcastle Electric Supply Co., to their mutual advantage, and the consumption per head of the population in the area at the present time was 400, one of the largest figures in the Kingdom. By mutual arrangement between the company and the contractors, an electric iron was given free to each consumer having a new installation, the view being that the use of the iron would lead to further demands for apparatus. He suggested the formation of electrical sections of Chambers of Commerce and Chambers of Trade. Such a Committee had been formed in the North, on which all parties co-operated, and he attributed to it a good deal of the success achieved there.

Mr. A. C. CRAMB (Borough Electrical Engineer, Croydon) congratulated the Council of the E.C.A. upon its change of policy in regard to the functions of supply authorities and contractors, and said that the manner in which the president had tackled the question of the relationships between the two bodies was deserving of the gratitude of the members. The contractor must realise that the supply engineer was being pressed all the time to get on with the job, but, however fast he was developing the business, he was not doing it a quarter as fast as it should be developed. He himself had no ambition to become an installation engineer; he felt that the general work of contracting should be carried out by contractors, but the supply authorities should have the right to step in where the contractor failed. The contractor was out for business, and there might be certain directions in which electric supply could not be developed by the contractor because the work did not pay him and was not worth bothering about. In urging that each side should try to see the matter from the other's point of view, he said that although there might be some discussion as to whether or not the terms of the agreement between the E.C.A. and the I.M.E.A. were satisfactory, he believed that it was not so much the terms mattered, but the spirit behind them.

Mr. W. R. RAWLINGS said that if the constitution on the supply side were run by men of the Christie-Cramb order they would all be more wealthy, and the troubles of to-day would not exist.

Mr. HOWARD SMITH (London) suggested the formation of a body representative of all insurance companies to ensure that all installations were carried out properly.

Mr. H. MOSS (Bradford) pleaded for greater co-operation between the members of the Association. He also urged that supply authorities should supply contractors in their areas with complete lists of consumers on their mains, in order to guide the contractors in their canvassing. His Branch had repeatedly asked the Corporation for that information, but without result.

Mr. FINLAY, at the end of the discussion, expressed his thanks for the manner in which the paper had been received.

Apprenticeship.

By WALTER RIGGS, A.M.I.E.E. (Past President).—*Abstract.*

This paper commenced with a review of the institution, growth and subsequent decline of the apprenticeship system. The author said that the introduction of mass production was leading to a state in which the man would become the adjunct of the machine, earning high wages while his job lasted but unable to do other work. The electrical contractor, however, needed a man with a general or all-round training. It was necessary to distinguish between boy labour and apprenticeship. A boy labourer was under no obligation to attend technical classes to better himself nor was his employer bound to teach him the trade. He had little chance of becoming a skilled man and being discharged when reaching a certain age merely helped to swell the ranks of the unemployed. He was presumably, however, eligible to join the E.T.U. and was entitled to the full rate when employed. On the other hand the

apprentice was bound for a term of years; he received instruction from his employer; and attended classes, often in the employer's time. The existence of men with a smattering of wiring knowledge was a constant and serious source of danger to the genuine wiring contractor, for they often set up on their own and not only cut prices and did bad work, but lowered the status of the sound contractor who was often placed in the same category. The E.C.A. had a definite apprenticeship policy and considered that an electrical fitter should be properly trained in wiring lighting and power installations (a.c. and d.c.); telephone and bell installations; erection and setting to work of industrial motors, generators, accumulators, &c.; erection and connection of switchboards; underground and overhead mains work; and the construction, use, and installation of domestic and industrial appliances. The Association had agreed that after six months' probation an apprentice should be indentured for at least five years and until he attained the age of 21. Two years or less spent in a technical school after the age of 16 should count as part of the period. A form of indenture was drawn up and it was arranged for each branch to form an apprenticeship committee to arrange suitable classes, &c., with the local educational authorities. In addition the Association had made a definite effort to encourage apprentices to take the "Grade I" and "Final" examinations of the City and Guilds of London Institute, by the award of medals and educational grants. The author suggested that the giving of "time off" to apprentices to attend classes should be regularised on a national basis. It was also considered that the practical part of the examinations should include the inspection of installations actually carried out by candidates in their own districts. The chief obstacle to the universal adoption of the apprenticeship system was the fact that a firm employing boy labour could easily underquote another employing journeymen and a few apprentices. Further, there was the obligation on the employer to see that his apprentice was taught the trade. Mr. Riggs suggested that a similar system to that applied to boys in the agricultural industry could be adopted, *i.e.*, the fixing of a wage for lads up to 21, no matter for whom they were working. That would involve apprenticeship not to an individual employer (which was difficult owing to the varying state of trade with individual firms) but to an association, such as the E.C.A., which would act as a clearing house to transfer apprentices where necessary; arrange for lads to attend day technical classes; and supervise training. All firms would then apply to the association for apprentices and the number for any one firm would be limited. The next suggestion made by the author related to the allocation of the time of apprentices; for instance, for the first year the apprentice could act as stores boy to gain a knowledge of materials; the second year could be devoted to simple wiring; the third and fifth years spent in a technical school; more advanced practical work undertaken during the fourth year; and with contracting firms on plant erection and running and mains work during the sixth and seventh years. Arrangements could be made with regard to payment during the technical school periods. Such a scheme, it was claimed, would solve the question of unfair competition due to cheap labour, automatically arrange for technical education, and provide the necessary amount of skilled labour for the industry. A wages board should be formed for the industry, and the rate of apprentices' pay should be kept fairly high. The ability to move an apprentice about would give a measure of elasticity which was at present lacking. Another thing which could be introduced was an "employment book" similar to the "discharge book" used in the Mercantile Marine. That would contain full particulars of the individual's training, conduct and ability and would save a great deal of time when employers were engaging a man.

An appendix to the paper set out in some detail the syllabi of the examinations of the City and Guilds of London Institute—Department of Technology, with a list of text-books and works of reference.

Discussion on Mr. Riggs's Paper.

Alderman R. TWEEDY SMITH, J.P. (Solicitor to the E.C.A.) said that in connection with a school of arts and crafts, of which he was chairman, meetings had been held with employers with a view to fixing up some arrangements of the sort indicated in the paper, but the trade unions had opposed them all the time. The future of the industry was fraught with grave danger unless more technical education could be provided. There was a shortage of jointers, and the municipalities, without a system of training of their own, were robbing the contractors of the jointers they had trained, which was most unjust. Surely municipalities should take the lead in training jointers. Employers were told that they must not have more than one apprentice for every ten employés, and the rules and regulations of the Joint Industrial Councils were such that they could not carry on. The present was a most favourable time to get those regulations altered. He represented No. 9 Area on the Joint Industrial Council, and there had been some talk as to whether they should carry on the Council at all unless there was some radical alteration as regarded apprentices, the giving of notice, and kindred topics. The solution of the difficulties in the electrical industry would come when those engaged in the industry had the same statutory standing as doctors and lawyers, and when nobody would be allowed to practice unless duly qualified, because, after all, the safety of the public was involved.

Mr. A. E. CHESTERS (Liverpool) did not like the suggestion in the paper that boys should be transferred from one employer to another. He disagreed with Mr. Riggs's suggestion of a non-continuous period of technical training. It was absolutely necessary, particularly between the ages of 16 and 18, that a boy should attend day classes, even though only once or twice a week. At 18 he would join evening classes, and from the age of 18 to 21 there would be an unbroken period of service with his employer.

Mr. J. CHRISTIE (Borough Electrical Engineer, Brighton) described a scheme of apprenticeship which he had devised in Brighton some years ago to meet the difficulty of getting boys, and particularly the difficulty of getting jointers and skilled juniors in the meter department, owing to the rapidly increasing amount of work to be done. That scheme had been very successful indeed. At intervals the Corporation engaged a limited number of apprentices, who were given a beautiful indenture, the conditions of which he had drafted, in collaboration with the Town Clerk. It was a very useful asset to any young man, carried great weight with employers, and he believed that it gave a young man preference over others when applying for a post, other things being equal. The indenture provided that if any troubles arose with regard to apprentices the final decision should rest with the Lighting Committee. Finally, Mr. Christie urged the necessity for making adequate provision to provide skilled men to deal with the enormous influx of business which must be met in the near future in this the key industry of the country.

Mr. LEON GASTER (London) pleaded with education authorities to take the subject of lighting seriously to heart, because it was only with the aid of a knowledge of the general principles of good lighting that those in the industry would be able to carry conviction to the consumers.

Mr. W. R. RAWLINGS expressed indebtedness to the City and Guilds of London Institute, which to-day was doing perhaps the best work of any authority in providing technical education for boys. The Institute had asked the E.C.A. to co-operate in the preparation of their syllabus, and the E.C.A. should put forward suggestions in this connection each year. He objected to giving apprentices facilities to attend day classes.

Mr. HEYWOOD (Rochdale) also pointed to the difficulty with regard to attendance at classes, inasmuch as contractors' apprentices were often employed on installations many miles from their homes for weeks or perhaps months at a time. Difficulty had been experienced in Manchester in obtaining technical education because the education authorities would not recognise a lad unless he had attained practically the matriculation standard. One could not expect boys of that standard to become apprentices.

Mr. T. W. SAMPSON (Sheffield) urged the Apprenticeship Committee of the E.C.A. to bear in mind that the majority of the lads who attended classes were not *bona fide* apprentices, and the danger of employing such lads on wiring work after a course of evening study only was one to be guarded against. Last year in Sheffield there was a Grade I class of about 70 students, but he believed that not more than 20 per cent. were connected directly with the electrical industry.

Mr. RIGGS, replying to the discussion, said that in suggesting that apprentices should be given facilities to attend day classes during a period of two years he did not intend to prohibit their attendance at evening classes if they wished to attend. The difficulty was that in large cities, such as London, the boys might have to travel considerable distances between their homes, their work, and their classes, which was a factor of importance.

Inventions Commission.—The Royal Commission on Awards to Inventors sat at the Law Courts in London on June 21st, to consider a claim by Mr. C. E. Stuart in respect of the electro-deposition of iron as applied to aeroplane engines. For the applicant it was explained that Mr. Stuart, who was now in South Africa, was a first-class air mechanic in the Royal Air Force in 1915, and at the end of that year was put in charge of a shop for dealing with worn parts of aero engines. The difficulty was to secure an even deposition of metal on worn parts. In February, 1916, he conceived the idea of building up a vat of wax round the part to be plated, and later he employed a spiral wire operated by a rocking arm, by means of which it was possible to keep the solution continuously agitated. Both these processes, he claimed, were distinctive inventive steps. The work at first was only done in copper, but later it was applied to harder metals and eventually to iron. In the work another air mechanic named Lovelock was associated with Stuart, and he was now a co-applicant. The log-books showed that parts which became worn after 50 hours ran for 200 hours after electroplating by this process, and a very large amount of money must have been saved. The Commission reserved its decision.

Special Libraries Directory.—As our readers are aware, in view of the enormous amount of scientific and other special information now available in periodicals and libraries, the Association of Special Libraries and Information Bureaux has been formed to assist in making such information available to all who wish to use it. Associate membership is open to anyone interested. With the assistance of the Carnegie United Kingdom Trust the Association has undertaken, as one of its first activities, the compilation of a directory of sources of specialised information in Great Britain and Ireland. The general editorship of this important work has been entrusted to Mr. G. F. Barwick, late Keeper of Printed Books at the British Museum, whose scholarship and long experience will be invaluable for such a task.

The Jubilee of the Telephone.

Commemoration by the Institution of Electrical Engineers.

To such an extent has the telephone become an integral part of commercial and social life that only with some difficulty is the fact realised that merely 50 years have elapsed since the spoken word was for the first time transmitted electrically from one room to another in a house in Boston, U.S.A. The telephone industry has developed phenomenally during the half century since Alexander Graham Bell, a characteristic Scot, impecunious but indomitable, convinced that he had discovered something that would meet a need of humanity, devised his receiver and exhibited samples at the Philadelphia Exposition in 1877. The capital invested in the telephone business is not far short of 500 million pounds sterling, whilst the effects of the intercommunication afforded between individuals and races are incalculable and far-reaching in their results.

Jubilee Luncheon.

Thursday, June 24th, was selected by the Institution of Electrical Engineers as the date for celebrating the jubilee of the telephone.* The proceedings commenced with a luncheon at the Hotel Cecil, London, at which 263 covers were laid and the presence of distinguished guests and a number of ladies added materially to the pleasure of the function.

Mr. R. A. CHATTOCK, president I.E.E., occupied the chair, and when the loyal toasts had been honoured, he explained that that was the earliest date they had been able to choose to celebrate the jubilee of a remarkable achievement that had transformed the daily life of all civilised peoples. On March 10th, 1876, Bell was granted a patent which, by judicial pronouncement, was said to have introduced a new art to the world.

Sir W. MITCHELL-THOMSON, Bt., K.B.E., P.M., Postmaster-General, said the telephone had become a practical necessity of civilised life. Last year as many telephones were installed as during the first 20 years of the development of the telephone. At present there were about 1,430,000 telephones in the country, and the number of effective calls last year was over 1,000 millions. The Post Office was pushing on with the development of the underground trunk cable system and with rural telephones. In the last three years they opened nearly 800 rural telephone exchanges. The jubilee of the telephone, he hoped, would coincide with the completion of the first large London automatic exchanges; it coincided with a deliberate and co-ordinated effort to improve international telephone facilities in Europe. At the present moment a conference was being held in Paris for that purpose, and there was just being completed a new submarine cable to Holland with 12 speech channels which would bring the cities of Germany into complete telephonic touch with this country. Later in the year a new cable was to be laid to France with 24 speech channels, and a similar one to Belgium. The third event of the jubilee year was that ordinary two-way Transatlantic telephony was well within sight, and he hoped when the difficulties in the coal industry were at an end they would be able to bring those experiments to a successful conclusion.

Faraday Medal Presentation.

The company then adjourned to the I.E.E. lecture theatre, where the Faraday Medal was awarded to Col. R. E. B. Crompton, a past president and hon. member, for his services on behalf of electrical engineering.

Mr. W. B. WOODHOUSE and Mr. ROGER T. SMITH spoke in appreciation of his achievements, particular stress being laid on his pioneer work and his whole-hearted support and guidance of the International Electrotechnical Commission. Mr. R. A. CHATTOCK, president I.E.E., then presented the medal.

Col. R. E. B. CROMPTON, in returning thanks for the honour done him, was not sure that he deserved all that had been said of him, but he could say that he had achieved a measure of success through finding good men to help him and praising them when they did something good. In speaking of good men he must mention a good woman—his wife—who had brought together, with that instinct which was woman's, people who had supported him and Ferranti (not only financially, but by *believing* in them) in their early endeavours to supply electricity in London. His wife had urged him to seek the advice of others whenever a knotty problem presented itself, and he counted himself fortunate in having done so. As for the I.E.C., he was not so conceited as to think that England was the only country in the world; by collecting the best men from all countries and gathering their best thoughts and ideas was the road to progress.

Jubilee Lecture.

A lecture, which was broadcast by the B.B.C., on "The History and Development of the Telephone," was then delivered by Sir OLIVER LODGE, D.Sc., F.R.S., hon. member, with the aid of lantern slides. The articulating telephone, he said, was an instrument of absurd simplicity, invented by one who was not learned in physical science, but interested in the promotion of clear articulation and intelligibility of human speech. His aim was not to produce speech *de novo*, and he was not a professed electrician; his electrical investigations were undertaken to solve some of his acoustic problems. He (Sir Oliver) was disposed to characterise the telephone as the greatest invention of the 19th century, for it had not only had a wide effect in extending human intercourse, but had put into the hands of experimenters an instrument of great value. It had revolutionised the detection of minute currents in all manner of sciences, it had made measurements easy which would be difficult without it, and in many cases had superseded the eye as an observing instrument. Now, supplemented by further discoveries, it bade fair to make wireless telephony possible all over the world, with international results which could only dimly be foreseen.

Mr. J. E. KINGSBURY proposed, and Prof. J. A. FLEMING seconded, a vote of thanks to the lecturer, which was passed with acclamation.

The Conversazione.

In the evening the annual conversazione was held at the Science Museum, South Kensington, members and friends being received by the President and Mrs. Chattock and the I.E.E. Council. Light refreshments were served and, in addition to a programme of vocal and instrumental music, an instructive exhibition was arranged (by courtesy of Col. H. G. Lyons, F.R.S., director of the museum, and Col. T. F. Purves, O.B.E., M.I.E.E., engineer-in-chief of the General Post Office) in two sections and assembled in datal order to illustrate the development of telephone apparatus and line plant, respectively.

The exhibits include original Reis "telephones," the first electrical apparatus for the transmission of sound invented by Philipp Reis, of Friedrichsdorf, in 1863, which, however, was not, like Bell's, a speaking telephone. Early Bell telephones, one of which instruments is very similar to that exhibited by Graham Bell at Philadelphia on June 25th, 1876; the diaphragm is of goldbeater's skin and has at its centre a piece of cork to which is attached an armature. Two subsequent forms of the Bell telephone are also shown, as is also a selection from the original apparatus made and used by D. E. Hughes in connection with his discovery of the microphone in 1878. The Edison carbon transmitter, the main features of which (the first commercial application of the carbon transmitter) were patented in 1877. Early telephone instruments selected to show the evolution of the present-day telephone from the original apparatus of Bell, Hughes, and Edison. Telephone switchboards included a series of manual boards from 1888 to the present day, and automatic apparatus, some of A. B. Strowger's original instruments, and also a working model of the automatic telephone system for London and the provinces which may be inspected and operated. Models of two-wire and four-wire trunk telephone repeaters (in operation), and an historical series of thermionic valves will be found in the adjacent wireless section; also testing equipment as used by the General Post Office for measurements on trunk telephone lines. Samples of submarine and underground telephone cables, &c., are on view, and a contrast is afforded by the presence of a modern radio broadcast receiver alongside original primitive types.

Besides the General Post Office and the Institution of Electrical Engineers, Messrs. Siemens Brothers, Standard Telephones & Cables, Ltd., the Automatic Telephone Manufacturing Co., the British L. M. Ericsson Telephone Manufacturing Co., and the Peel-Conner Telephone Works supplied or lent material, and the apparatus will remain at the museum for about six weeks so that the public may have an opportunity of inspecting it.

* See also ELECTRICAL REVIEW, March 5th, 1926.

An Electrically-Controlled Insect House.—An electrically-controlled insect house which has recently been equipped in the United States for the San Joaquin County Insectary at Lodi, California, is said to be the first Insectary to use electric heat. The practice hitherto has been to use gas or other fuels, with manual temperature control. This Insectary is engaged in research work to determine the possibility of using the "lady-bird" to rid vineyards of the "mealy bug," a pest which is causing much loss. This is a small insect which multiplies very rapidly and thrives on the juices of the young and tender grape-vine shoots. For process purposes the rooms are kept perfectly dark and are held at a constant temperature of 65 deg. Fahrenheit, until the potatoes which are used for experimenting have sprouted and developed long shoots. The purpose of a dark room is to cause the sprouts to grow long and spongy, with a minimum of leaves. The San Joaquin County Insectary has four rooms, each approximately 12 feet long, 6 feet wide and 8 feet high. In each room is installed an Edison 2,000-watt heater. The temperature is regulated by a thermostat and a contactor manufactured by the International G.E.C. of America.

The Standardisation of Frequency.

A Dual-Frequency Converter.

By R. L. ACLAND, M.I.E.E.

PART VI of the Ministry of Transport's Report on "The National Problem of the Supply of Electrical Energy" deals with the all-important subject of the Standardisation of Frequency, which will entail a very big outlay if 50 periods is to be made universal, when there exist such undertakings as those of the Birmingham and Glasgow Corporations working on 25 periods, the Newcastle-on-Tyne Electric Supply Company on 40 periods, and nearly half the Power Companies and over 80 other supply undertakings of various sizes working on some dozen other odd frequencies.

The author, when borough electrical engineer at Chesterfield, was up against the same problem, as within a few miles of the town are the works of the Staveley Coal and Iron Company, which has a large and well-equipped generating plant running off waste gas from coke ovens and blast furnaces; the company is thus able to supply power at a very attractive figure, but its frequency is 30 periods, consequent on some of the early plant being of American origin.

The Corporation had to decide whether to adopt the more common frequency of 50 periods, and use some form of frequency changer for the Staveley supply, or 30 periods and be able to connect consumers direct to Staveley. The Council was divided into 50's and 30's, and it was decided to ask for a ruling from Whitehall, which was given in favour of 50 periods.

The first supply from Staveley was taken through a 400-kW motor generator, and a 500-kW rotary converter was installed to run off the Corporation 6,600-volt, 3-phase, 50-period generator through a step-down transformer.

For the next extension, the author required a stand-by for both the above machines and having regard to the lack of space available, efficient operation, and capital outlay, decided to adopt one machine for both duties, namely, a rotary converter which could run direct or inverted on 30 or 50 periods, and as a shunt or compound machine on the d.c. end for lighting or traction supply, and in parallel with steam-driven generators.

The matter was taken up with the designers of the British Westinghouse Company, of Trafford Park, who had supplied all the other plant with which the machine had to operate; a careful study was made of the conditions that had to be met, and the design of the rotary was shaped accordingly. The machine was built and passed its trials successfully, but after being installed, considerable adjustment of the compound and interpole windings by means of diverters was necessary to get the best results when operating in parallel with the steam sets.

The machine had to give its rated output at two different speeds, direct or inverted, by means of regulation on a separate exciter mounted on the rotary shaft.

It is fitted with interpoles and compound wound, and a separate compound booster is mounted on the same traction supply, and in parallel with steam-driven shaft and connected to the a.c. side, controlled by a regulation. The compound windings of the main and booster fields are connected in series, and are changed or short-circuited in accordance with the direction of supply, and whether the machine is connected to the lighting or the tramway bus-bars.

The machine is generally run up on the traction bus-bars at 500 volts as a compound motor, synchronised at 30 periods, and then disconnected from the d.c. supply, after which the compounding is reversed and the machine paralleled with the d.c. supply.

In order to ensure the reliability of the supply, efficient running, and protection of all the plant in the various combinations possible, the switchgear was of necessity somewhat complicated, and mechanically interlocked to prevent as far as possible mistakes when synchronising or switching in, and it is interesting to record that owing to the careful study of the conditions to be met and the design of the rotary, the arrangement has worked without a hitch since it was installed in 1915.

The installation was fully described with diagrams in an article written by Mr. E. P. Austin (see ELECTRICAL REVIEW, May 5th, 1916), who was chief assistant electrical engineer to the Chesterfield Corporation, and collaborated with the author in the design of the lay-out, and from that article information has been taken for the preparation of these notes.

Mr. D. H. Davies, the present borough electrical engineer, has recently placed an order for a similar machine, but of 1,000-kW capacity, and the original one, believed by the author to be the only one in the country, has only just been "discovered" as a suitable method of interconnection between two networks working on different periodicities when one of them is also using d.c.

Thus the little machine that has been working in obscurity for eleven years has become quite famous in its old age.

Municipal Capital Costs.

By "INTERESTED."

No part of the salary or wages of the Council's permanent staff (including employés) ordinarily charged to revenue account shall be defrayed out of the moneys borrowed under these sanctions. There will, however, be no objection to payment out of the loans of a reasonable remuneration for additional work performed outside normal hours, or where it is necessary temporarily to employ substitutes to take the place of the permanent staff during the time that the staff is engaged on the work for which the loans are sanctioned, a sum equal to the reasonable remuneration paid to the substitutes.

Thus the decree from the Electricity Commissioners to local undertakings when forwarding the necessary sanction or permit for obtaining a loan for work of a capital nature. Why in such peculiar manner? Can it be that every small capital job carried out by direct labour is looked upon with disfavour? Is it not a suggestion that *all* new work shall be given to an outside contractor?

Dealing with the staff only, a certain case may be made out for the Commissioners, but "other employés" is quite another matter, and places the engineer in an invidious position.

In the last few years the use of electricity has so rapidly increased that municipal supply stations seldom experience a whole year without some expenditure of a capital nature. Now the fiat has gone further that engineers, fitters, bricklayers, carpenters, &c., ordinarily chargeable to revenue account must on no account leave their customary duties and change, even for a short period, to that for any extension or new work of any description, unless other men are engaged temporarily to take their places, otherwise the time properly allocated to the new work must be charged to revenue account.

One can easily imagine many such conditions particularly applying to the question. One or two concrete examples here will be sufficient by way of clear illustration:—

(*a*) When preparing foundations for installing some new boilers, it is found imperative to erect certain pipework and connect up an ejector for the purpose of keeping at a low level the flow of water into the excavations; a contingency not included in the boilermaker's contract. The order is to charge such work to revenue account, although had sufficient foresight been used to incorporate in a suitable clause of the contract some proviso making the contractor liable for such a possibility, any such extra sum incurred would be allowed as a capital charge without comment.

(*b*) In other works, upon the advice of the engineer, the local authority decided to place a contract for the supply of certain steam and feed pipes together with the valves necessary for connecting a new bank of boilers to the steam ring, including the requisite piping for heaters, drains, &c., and to erect by direct labour as the work on the boilers progressed. For that purpose it is directed that temporary fitters and mates must be

engaged, for if any of the permanent establishment be employed for a few weeks, their time is to be charged to revenue account. On the other hand, if the work of erecting and connecting up was included in the contract with the manufacturers of the pipes or valves, it is suffered to be a legitimate capital charge.

One could continue with numerous further examples, but it is sufficient to say that there are not a large number of municipal electricity stations who engage temporary employés for all work of a capital nature carried out by direct labour. Whether it is customary practice for them to charge the time of any permanent man thus employed temporarily upon capital work to revenue account is a question the answer to which must include a big "IF," and probably something about the men being engaged permanently for new work and only temporarily employed on repairs and maintenance.

Surely this must be an instance of theory without practice unfortunately prevalent with certain accountants who dabble in works costs accounts without having sufficiently studied the wide, practical side of the subject.

That first paragraph could be redrafted so as to allow a certain latitude in the proper circumstances.

Research in Illumination.

A Review of the Work of the Illumination Research Committee.

AT a recent meeting of the Illuminating Engineering Society a paper was read by Mr. J. W. T. Walsh entitled "Research in Illumination; with particular reference to the work of the Illumination Research Committee of the Department of Scientific and Industrial Research." Sir John Herbert Parsons, a past president of the Society and a member of the Illumination Research Committee, presided.

In the introductory section of his paper Mr. Walsh emphasised the great importance of assistance from the physiological side in dealing with lighting problems. The final judgment of the work of the illuminating engineer was "What will the eye think of it?" The appointment of the Illumination Research Committee marked an important advance, and on the Committee the Medical Research Council was adequately represented.

Mr. Walsh illustrated the distinction between pressing problems that could be relatively quickly solved and "fundamental research," which frequently required considerable time, but was of immense importance in relation to everyday problems. Amongst such fundamental problems he mentioned the nature and effects of glare and the relation of intensity of illumination to fine work; the latter had an obvious bearing on industrial operations of all kinds, while the problem of street lighting was an instance of the importance of eliminating glare. A third fundamental investigation now being carried out had a bearing on the natural lighting of buildings; in that connection an extensive series of investigations was being undertaken at Teddington by the National Physical Laboratory.

Research on the relation between illumination and the ease and accuracy of performing fine work has been proceeding for some time. Printing was selected as the first process to be studied, and experiments have already demonstrated the close relation that exists between illumination and output, while the Committee has had the valuable aid of the Joint Industrial Council of the Printing Trades of the United Kingdom; it is also aided by representatives of the Medical Research Council, and it is in close co-operation with other bodies concerned with research on illumination. Amongst other "special problems of urgency" Mr. Walsh mentioned the investigation of enamelled iron reflectors, which have recently been the subject of a B.E.S.A. specification; the study of the lighting of picture galleries, especially with a view to eliminating inconvenient reflections from the glazed surfaces of pictures; the study of the effect of colour and distribution of light, and such methods as semi-indirect lighting, artificial daylight, and "artificial window" effects; the effect of "flicker"; the brightness of diffusing glassware, and the temperature attained in lighting units under various conditions of operation. In conclusion, Mr. Walsh expressed the hope that his brief sketch of the work of the Committee would arouse interest in these problems. A number of the researches would shortly be dealt with in early publications of the Committee. He hoped that the paper would also be useful in leading to suggestions of other subjects for research.

A good discussion followed, in the course of which general appreciation was expressed of the procedure of bringing a survey of this work before the notice of the Society, so that it might become more widely known. Mr. C. C. PATERSON, chairman of the Committee, who opened the discussion, alluded to the pioneering work done by the Society and by Mr. L. Gaster in initiating this important research. Miss WIGGINS acknowledged the great assistance which the Committee had rendered in connection with various problems being studied by the B.E.S.A. Illumination Committees. Mr. P. J. WALDRAM suggested that the researches at the N.P.L. on daylight illumination should be supplemented by measurements showing conditions in various cities, where, owing to the presence of smoke, different results might be expected. Mr. A. CUNNINGTON alluded to problems on railways in connection with the influence on the vision of drivers in passing through tunnels as an example of the influence of "glare." Mr. J. S. DOW referred to the complexities of comparisons between natural and artificial lighting, and suggested that an investigation with a view to ascertaining the quality of light most "restful" to the eyes might yield useful results.

Sir JOHN PARSONS, in closing the discussion, emphasised the great importance of studying lighting from the physiological side; at present, too few ophthalmologists took an interest in lighting problems and every effort should be made to bring the subject before their notice. Mr. LEON GASTER recalled that the very first paper ever read before the Society, on the subject of "glare," was presented by the chairman (Sir John Parsons). The work of the Illumination Research Committee provided an example of the special function of the Illuminating Engineering Society of interesting all kinds of experts in the subject, and initiating research by others outside its ranks, as well as its own members. It was most important that work of this kind should receive widespread attention, and the Society, in thus acting as "a clearing house for information," was achieving one of its main objects.

Legal.

Wright v. Levinsky.

IN the Lambeth County Court, on June 21st, before Judge Parry, Mr. Stanley A. Wright, electrician, New Cross, S.E., sued Messrs. I. & M. Levinsky, proprietors of the Electric Theatre, Upper Norwood, S.E., to recover £9 11s. 6d. for work and material supplied in repairing a generator. There was a counterclaim for £40, stated to be loss of takings at the kinema, and the amount the plaintiff had charged when he previously repaired the generator.

Mr. HARGREAVES, for the plaintiff, said that in June, 1925, the plaintiff was asked to put right a generator at the defendants' theatre. He did so, by fixing a new commutator, &c., and charged £10, which he was paid. He had given a written guarantee that the work he had done would last for 12 months or more. In November of the same year he was again asked to see the generator, and he found that the commutator had been tampered with, and some soldering had been very badly done. The plaintiff gave evidence in support of these statements. In cross-examination, he denied that whilst he was repairing it, the generator was burned out.

For the defence, MARIE LEVINSKY gave evidence, and strongly denied that the generator had been tampered with. When the plaintiff burned out the generator the show had to stop.

ALFRED HOBBS, an employé of the Crypto Company, said that when he tested the generator he found that several segments were smaller than the proper size, it was a bad commutator, and it was not in working order. An employé of the Electro Dynamic Construction Co. also gave evidence to the effect that the work was bad and defective.

ABRAHAM LEVINSKY stated that the plaintiff had called four or five times from June to November to put the machine right. In answer to questions by Judge Parry, the witness said there was no electrician looking after the generators employed in the theatre.

In giving judgment, Judge PARRY said that no doubt it was owing to the fact that nobody looked after the generators that they constantly went wrong. He gave judgment for the plaintiff for £5 5s. with costs, and dismissed the counterclaim.

War Bonus Appeal Dismissed.

A RECLAIMING note for pursuer has been disposed of in the Court of Session, Edinburgh, in the action in which a lamp trimmer in the employment of the Edinburgh Corporation electricity department sued the Corporation for £102. The action was a test case in which claims by a large number of Corporation employés were involved, and the point raised was whether those employés were entitled on their return from active service to the bonuses which were paid during the period of the war to the employés who remained at home. Lord Constable in the Outer House held that the words in the Corporation's resolution "the pay presently received" were definite and unambiguous and did not include subsequent bonuses. The reclaiming note was refused and judgment affirmed.

Guaranteed, Ltd., v. Powell & Co.

IN the Shoreditch County Court, on June 22nd, before Mr. Registrar Wickham, Guaranteed, Ltd., Victoria Street, S.W., electrical and hardware goods factors, sued Llewellyn Powell and Company, Brixton, S.W., electrical goods dealers, to recover £4, the balance due on electric lamps, &c., supplied. The defence was that the goods were on sale or return, the invoices could not be understood, no proper credit notes were

given for goods returned, and the plaintiff's representative had failed to call and straighten the matter out, as he had been asked to do. Defendants had twice offered to deliver the goods back, and had informed the plaintiffs that they were at the defendants' premises entirely at the plaintiffs' risk. The defendants also denied any liability for breakages or shortages. The plaintiffs' representative agreed that the order given was for goods on sale or return. Goods to the amount of £21 were supplied, and as against this credits had been given for £17 for goods returned.

The defendants produced a receipt which was given by the plaintiffs' bicycle boy for the goods that they returned, which contained more articles than they had been given credit for. They had also sent goods by parcel post, but could not produce a receipt. The REGISTRAR said that the plaintiffs must be bound by the signature of their bicycle boy, and credit would have to be given in full for that amount. As to the parcel post goods the defendants would have to pay. His judgment would therefore be for the plaintiffs for £1 18s. 3d. and costs.

Greenock Corporation v. The Admiralty.

IN the Court of Session, Edinburgh, on June 19th, a decision was given in an action by the Corporation of Greenock against the Admiralty for £250,670 with interest from August, 1923. Within the area supplied with electricity by the Corporation are situated the Royal Naval Torpedo Factory, Fort Matilda, and other undertakings which were engaged in the production of munitions during the war. These created a greatly increased demand for electricity, and the Corporation stated that it made extensive additions to its electrical plant and buildings to meet the demand. In December, 1918, an agreement was arrived at with the Admiralty under which the Government undertook to relieve the Corporation of any capital expenditure in excess of post-war prices ruling two years after the war in connection with any plant installed during the war period and two years immediately thereafter and to relieve the Corporation of any redundant plant. The main question in dispute was with reference to the meaning of the expression "after the war" and "war period" used in the correspondence. By Orders in Council it was declared that August 31st, 1921, should be treated as the date of the termination of the war. The Corporation maintained that two years after the war referred to in the agreement was to be calculated from that date. The Admiralty maintained that the war period expired on December 14th, 1918.

The LORD ORDINARY held that the war period in the agreement ended on August 31st, 1921, and *quo ad ultra* allowed parties a proof of their averments.

Caldwell v. R. F. H. Radio Co.

AT the Birmingham County Court on June 23rd, Judge Dobb heard an action by Mr. Albert V. Caldwell, trading as the Sherwood Electric Works, Nottingham, against the R.F.H. Radio Co., Birmingham, claiming damages in respect of a four-valve receiving set. Plaintiff alleged that the defendants guaranteed the set to be capable of receiving a number of stations' transmissions, whereas he found that only Nottingham and Manchester could be heard distinctly and London and Birmingham faintly. At that stage the judge ordered that a demonstration should be given in the Court on the following day. This was done and His Honour pronounced the demonstration a failure.

Mr. W. I. ROGERS, for the defence, said that the set had been knocked about since it was delivered to the plaintiff in 1924. It was urged that the set complied with the guarantee.

His HONOUR held that the amount of damages due should be the difference between the value of the set and the cost of one which would carry out what was claimed for the set. He assessed this at £21 and gave judgment for the plaintiff for that amount.

Alleged Conspiracy to Defraud.

FURTHER evidence was given at the Leicester Police Court on June 25th in the case in which Charles Cohen, Dalston, and Leonard Louis Weiner, London, are charged with conspiracy to defraud. Evidence was taken showing that Weiner became bankrupt at Leicester with liabilities totalling £11,456, and witnesses deposed to the delivery of electrical and wireless goods to Weiner & Co. at Leicester. Mr. Hugh C. TOFIELD, electrical engineer, formerly managing director of a Birmingham firm of electricians, stated that in December, 1924, he received an inquiry from Weiner. He sent his catalogues, and later received a letter offering "D. Armstrong" as reference. On communicating with Armstrong he was informed that he had known Weiner for a considerable time, that their business relations were of the best, and the account was satisfactory. On that reference witness supplied electrical goods to a considerable amount. Accused were committed to quarter sessions for trial, bail being allowed.

British Thomson-Houston Co., Ltd. v. Walker.

IN the Chancery Division of the Northern Ireland Law Courts, on June 23rd, Mr. Justice Wilson granted the plaintiff company an injunction restraining George Walker, Belfast, from infringing its letters patent in respect of the leading-in wires and gas atmosphere of electric lamps.

Reviews.

House Heating. A general discussion of the relative merits of Coal, Coke, Gas, Electricity, &c. By MARGARET FISHENDEN, D.Sc., F.Inst.P. Pp. 296; 57 photographs and diagrams. London: H. F. & G. Witherby. Price 25s. net.

The subject dealt with in this book is one of great importance to all concerned in the development of the domestic load, especially in view of the serious consideration which has been given recently to the matter by a Special Committee appointed to report to the Government on the best means of securing a rapid increase in the consumption of electri ity in the home. Dr. Fishenden's investigations on behalf of the Fuel Research Board are well known, and in the present book she has written a very readable history of domestic heating from ancient times to the present day. The experimental work which has led to progressive improvement is given due notice, the scientific principles evolved being stated clearly and their application illustrated by current practice, while the trend of future development is considered in the light of present knowledge. Although not a text-book on heating for the general reader it is something much more valuable, and in the end serves the same purpose.

The subject matter is divided into eight chapters, which contain much data relating to heating and cooking equipment for fuel, gas, and electricity. Although in some cases comparisons are given, the reader will be able to re-arrange and check for himself the data provided in the various sections. The gas salesman will doubtless find in this book many passages useful to point his moral, but equally the electrical representative will be enabled to find the chinks in his competitor's armour and to pierce it effectively. Thus, for instance, the section on "Electric Cookers" is paralleled by those on "The Development of the Kitchen Range" and "The Development of Gas for Cooking Purposes &c." In these sections details affecting the efficiency of kitcheners, gas rings, and electric hot plates are discussed, and the information given is just what is required by the person who wishes to make correct comparisons under known conditions between these three means of cooking.

The electrical engineer will first turn to the chapter dealing with "Electricity for Heating, Cooking, &c.," and he will be rewarded by a historical introduction well worth reading by present day inventors. Modern types of radiators and air heaters are described, but, by a slip of the pen, the resistance elements are referred to as being "of relatively low power—say, 500 kW or less." The section dealing with "Cost of Electricity for Heating Purposes" opens with this glowing testimonial:—"No alternative method of heating can compare with electricity in point of adaptability, for it is capable of producing warmth not only wherever required, but in whatever form is most desirable to meet the particular occasion. It is controlled simply by touching a switch, and absorbs no labour in the cleaning or upkeep of appliances. Cost apart, electricity may be considered as an almost ideal source of heat for domestic purposes, and one which is capable of meeting the widest range of demands." (The high cost of electricity hinted at here is due to the relatively low thermal efficiency of the generating station to which reference is made in an earlier chapter.) Dr. Fishenden points out that electric heaters, though giving 100 per cent. efficiency, produce only 3,410 B.th.u. per penny (at 1d. per kWh) while coal, at 50s. per ton, even with only 25 per cent. of its heat usefully employed, will give 13,000 B.th.u. per penny. She mentions, however, several ways in which electric heaters "keep the occupants of a room comfortably warm on a less actual heat emission than would be necessary in the case of gas fires, or still more so in coal fires, where the chilling effects of draughts have to be counterbalanced by additional heat provision." As an example, Dr. Lulofs's experiment with electrically-heated mats is quoted. In this case 0.4 kWh equalled 1 lb. of coke, so that electricity was only 1¼ times as dear as coke at 45s. per ton. In Dr. Fishenden's view "until the weight of coal required to produce a unit of electricity approaches 1 lb., the conversion process will be wasteful. Until the price of electricity per unit approaches the price of coal per lb., electricity will be relatively expensive to the householder for continuous heating under ordinary circumstances." This is a view, however, which electrical engineers will do well to accept with caution. The bogey of "continuous" heating is by no means real where electricity is concerned, necessary though it is with coal fires. It is first cousin to the theory that to heat the occupants of a room, one must first heat the room. The efficiency of the coal fire is 25 per cent., which means that the householder buys and stores four tons of coal to get the value of one ton. This is hardly economic from the private or the national standpoint, for it involves an enormous amount of handling and transport. It would appear that even 15 per cent. efficiency at the generating station, using inferior coal handled in bulk should be superior to the 25 per cent. efficiency of the domestic coal fire, omitting the substantial reduction in the cost of local ash collection and the gain in national health due to the absence of smoke.

Turning to the section on "Gas Heating," one reads that "the high cost of gas (for heating) is a barrier not easy to surmount." The gas fire having an efficiency of 55 per cent. "actually delivers heat at about 2½ times the cost of the coal fire when used continuously." This statement should enable the supply engineer, acquainted with the modern

methods of heating by low-temperature electric radiators, to demonstrate that electric heating may be much cheaper than gas. There are many other points which could be developed on the information contained in this book.

The excess cost of electricity over coal and gas is not consistent throughout the book, and the electrical reader should make his own comparisons, based on the data given in the various sections and upon his own knowledge of the latest electrical heaters. For cooking it would appear that electricity at a halfpenny per unit is only just able to face gas at one shilling per therm, while for continuous water heating it is from 1¼ to 4 times as dear as coke at 40s. per ton. Compared with central heating, electricity is shown to be very dear, yet the fact remains that the same condition can be obtained with electricity used intermittently as with the hot water or steam system used continuously and at a competitive price where current is available at about ¾d. This only confirms the opinion that the comparison of electric heating costs on a B.th.u. basis is wrong in practice because the mode of applying electric heat is different and not directly comparable with the use of alternatives. It would have increased still further the value of the book if the author had investigated this aspect of the matter.

Throughout the book, which is well produced, there are copious references, in footnotes, to reports and other publications. These will enable the engineering reader, eager for further information and desirous of forming his own opinions, to follow up the subject. An adequate subject index is supplemented by a name index, which, however, could have been much improved by giving it the character of a bibliography for easy reference. Altogether the book, which is unbiased and impartial in its treatment throughout, should be valuable to all interested in the sale of electricity and in the manufacture and sale of heating and cooking equipment.

H. A. C.

The Secret of High Wages. By BERTRAM AUSTIN, M.B.E., M.A., Croix de Guerre (Fr.), and W. FRANCIS LLOYD, M.A., A.M.I.E.E.; with a Foreword by WALTER T. LAYTON, M.A. Pp. 111. London: T. Fisher Unwin, Ltd. Price 3s. 6d. net.

The authors visited the United States of America during the last quarter of 1925, with a view to seeking first-hand acquaintance of the American manufacturing industry during a period of unprecedented prosperity in that country, and at a time when Great Britain was in the throes of an industrial depression hitherto unparalleled, which has rendered workless a million and a quarter of our people.

They toured the most important cities of Eastern America, inspected 24 manufacturing works and other commercial organisations, and met many American industrial leaders. Upon their return, their impressions were described in a report, printed for private circulation, and this book is the direct outcome of the many suggestions received that the material contained in the report should receive a wider publicity.

Many of us, perhaps, are a little tired of having American efficiency methods thrust upon us, but the fact that cannot be gainsaid is that at the present time American industry is prosperous, while ours is not; that America can produce more cheaply than we can, and yet pay the workers higher wages. This being so, we cannot afford to neglect any opportunity of emulating the prowess of our friends across the water, and it is in this connection that this book is well worth studying.

It does not purport to give detailed information relating to the methods practised; on the contrary, the matter contained therein is brief, but it is presented in such a way as to ensure its purport being immediately recognised. The book is easily read. It contains in all fifteen chapters (all comparatively short) and nine of these are devoted to a brief exposition of cardinal principles upon which (in the authors' opinion) American industrial organisation is based. These principles may be summarised thus: (*a*) Promotion by merit only; (*b*) small profits and quick returns; (*c*) rapid turn-over needs less capital; (*d*) no limit to a man's output; (*e*) no limit to payment by results; (*f*) rival firms exchange ideas; (*g*) elimination of waste; (*h*) attention to welfare; (*i*) importance to research.

Particular emphasis is laid upon the fact that high wages do not necessarily mean high prices, but for high wages to be paid in conjunction with low selling prices quantity production must be resorted to, made possible by simplification, so that variety is restricted. In Chapter 3 some interesting information is given on how variety has been reduced in many instances, without the point being reached where sales begin to fall off on account of the monotony of design. It is rightly suggested that in Great Britain we have a very long way to go before that point is reached.

When a system of payment by results is instituted, no limits must be placed upon the possible earnings of the man; the more he earns, the better it is for the man, for the firm, and for the community. "In Great Britain it is felt, in some quarters, that high wages are not desirable. This attitude is partly accounted for by the belief that high wages must mean high prices of commodities." America has, however, proved otherwise. But Labour must do its part. It must back up the efforts of the management to ensure a large turnover at the smallest possible cost per piece; accept and exploit every new mechanical aid, and give whole-hearted support to the elimination of waste in every direction.

The authors contend that inefficient management is directly and solely responsible for "ca' canny," and this contention should be carefully considered by the management of every industrial works in connection with its own policy.

The book should be read by the manufacturer, by the manager, and by the workman. Our own ideas and methods do not appear to be bearing much fruit at the present time, and if they can be reinforced by the ideas and the methods of others, and thus prove more fruitful, it is up to us to take advantage of the opportunity, such as is vouchsafed us by this book.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Recent Battery Contracts.—The Alton Battery Co., Ltd., has received an order from the Kendal Corporation for a power-station type battery of 264 cells. Included amongst other recent orders are batteries ranging in capacity up to 2,500-Ah for Australia, South America, Federated Malay States, Colombo, India and Nyasaland. Fuller's United Electric Works, Ltd., has obtained a contract to supply 736 of its "TG 13"-type train-lighting cells, each of 180 Ah capacity, to the Bombay, Baroda and Central India Railway.

Hydro-Electric Development in El Salvador. — The Secretary of Public Works has intimated the intention of the Government of El Salvador to undertake a serious study of the Republic's potential hydro-electric energy and, to that end, a committee of experts has been appointed. It is proposed to nationalise the industry and to establish a department devoted entirely to hydro-electric development. Foreign enterprise will be welcomed and British firms might advantageously communicate with Señor Don Dr. Marcos A. Letona, Sub-Secretario, Obras Públicas, San Salvador.—*Reuter's Trade Service* (San Salvador).

Our Trade Names Supplement.—Owing to an unfortunate printer's error, Messrs. Delco-Light were described as makers of batteries, whereas they should, of course, have been classified under "Lighting Units and Batteries."

Municipal Trading at Sydney.—The Sydney City Council's proposals to undertake the wiring of premises and the sale of fittings and appliances was confirmed at a recent meeting. The opposition reserved the right to reconsider the scheme if the Labour Party was defeated at the next elections. In a statement the Lord Mayor denied that the Council was endeavouring to create a monopoly. He pointed out that the Council would have to purchase appliances from the wholesale houses and manufacturers and was not averse to entertaining selling arrangements for the apparatus handled by those firms. Many of the latter had already offered to co-operate with the Council in the business.

Unemployment.—There was an increase of 20,781 in the total of unemployed persons during the week ended June 14th, making the number 1,629,000, exclusive of persons who ceased work in the coal-mining industry on account of the dispute.

Large Oil Engines.—MESSRS. VICKERS, LTD., announce that they have recently completed an agreement under which the patents and designs of the M.A.N. (Maschinenfabrik-Augsburg-Nürnberg, A.G.) covering two-stroke heavy oil engines, both single and double-acting, will be available for their use in the British Empire and Colonies for both marine and stationary purposes. British-built Vickers-M.A.N. engines embodying the joint experience of the two concerns thus become available for installations of the largest powers.

E.D.A. Activities.—The latest publication of the British Electrical Develepoment Association is an attractively-coloured poster announcing that "With Electricity Women's Work is Quickly Done." The poster, which measures 20 in. by 30 in., depicts a mother and her family, accompanied by a number of electrical appliances.

Proposed South African Tariff Amendments.—The Union Government has under consideration a number of amendments to the Customs tariff. A list of these appeared in the *Board of Trade Journal* dated June 24th. Among the articles affected are:—Lampshades and reflectors; primary and secondary batteries; tramway construction or equipment requisites; and electric lifts. It is also proposed to extend preferential rebates to certain United Kingdom products including: Shades and reflectors; all kinds of electric lamps; machinery for mining purposes; electrical machinery and apparatus, including machinery for the transformation and conversion of electric power; primary and secondary batteries; and electrical cooking and heating appliances, including kettles and irons.

Social Events.—The London office staff of the Rawlplug Co., Ltd., held their annual outing on June 15th, about 80 being present. The party was conveyed by cars and charabancs to Hindhead. Sports were arranged and also a visit to Cowdray Park, the seat of Major the Hon. Harold Pearson. After lunch the chairman, MR. J. J. Rawlings, and the managing director, Captain L. Tweedie-Smith, referred to the progress made by the company. It was stated that the Rawlplug Co., Ltd., now has over 40 branch offices and agencies in practically every country in the world, some six subsidiary companies having been established. Works have been set up in the United States and Paris.

The annual outing to Blackpool, of the employés of Messrs. J. H. Tucker & Co., Ltd., took place recently; about 170 attended. Mr. S. R. Davies, who presided at luncheon, expressed regret that the directors were unable to attend. Mr. J. B. Tucker was not in robust health and Mr. T. R. Martin was still in America.

The annual outing of the warehouse staff of the Farringdon Road branch of Messrs. Falk, Stadelmann & Co., Ltd., took place on June 26th. About 450 persons were taken by special train to Margate. Mr. Max Falk (chairman) received the guests at luncheon, after which the party dispersed until their return by "special" to town in the evening

For Sale.—Messrs. Pennington's will sell by auction on July 6th, at 414, Richmond Road, Richmond, the stock-in-trade, fixtures and fittings of an electrical engineer and wireless contractor. Heston and Isleworth U.D.C. Electricity Department invites offers for a quantity of iron, copper, and brass scrap, also a 250-kW Davey-Paxman Peach engine and generator, with switchgear, &c. Mr. H. J. Shaw will sell by auction on July 8th, at 13, High Holborn, W.C.1, the stock of a wireless factor, &c. (See our advertisement columns to-day.)

Household Appliances.—The London Chamber of Commerce has established a Household Appliances Section through the medium of which it is hoped to stimulate public interest in such appliances as the result of a co-operative policy among firms offering *bonâ-fide* products. Firms in the section are expected to come together to discuss common problems and take action to protect their mutual interests. The elimination of unsound selling methods, the conduct of grouped selling campaigns and other matters are included in the programme. The Section was given a send-off at a luncheon held at the Holborn Restaurant on Monday last, when Mr. F. W. Goodenough, a member of the Executive Committee, gave a brief talk on co-operation in the household appliances industry. There was little of direct electrical interest in the proceedings; we anticipated that there would be more. Why was there no spokesman for electricity if the co-operation of electrical firms is sought? A number of electrical firms are interested in the movement and others should apply to the secretary of the Committee at 1-3, Oxford Court, London, E.C.4, for a pamphlet setting forth particulars. It gives the names of manufacturers and wholesalers who are on the executive. We are in agreement with Mr. Goodenough's general comments on the need for all makers of household appliances to co-operate to improve conditions in the home; to encourage the use of efficient and economical apparatus; and to improve the general prospects of the household appliance trade. He said rightly that the home-making and home-keeping industry was the largest in the kingdom.

Japanese Duty Remissions.—In order to encourage the home iron and steel industry the Japanese Government has decided to admit certain equipment free of duty for the purposes of the industry. The *Board of Trade Journal* gives a list of this equipment, which includes magnetic separators and sintering machines, transporting apparatus, motive machinery for rolling mills, carbon furnace electrodes, &c.

Trade Announcements.—By arrangement between MESSRS. ALFRED GRAHAM & CO. and the STERLING COMPANY, Mr. William Blogg, formerly sales manager to the latter company, who is now in Australia as managing director of the Amplion Australian Co., will act as agent in Australia for some of the Sterling Co.'s products but not for its radio goods.

During the partial rebuilding of Nos. 28 and 29, Hatton Garden, MESSRS. MARRYAT & PLACE, MESSRS. MARRYAT & SCOTT, LTD., and MESSRS. DEWHURST & PARTNER, LTD., have removed their business to No. 40, Hatton Garden, E.C.1.

The STEEL BAND CONVEYOR & ENGINEERING CO., LTD., Birmingham, announces that it has acquired the assets and goodwill of Steel Belts, Ltd. The stock and tools are being transferred to the company's works while Mr. H. Blackburn, managing director, of Steel Belts, Ltd., is joining the company. He will remain at Manchester for the present.

MR. CHARLES GATES is opening offices and showrooms at Eastbourne Place, Prince of Wales Road, Norwich. Telephone: Norwich 183. He is specialising in country house lighting and contracting work and now has no connection with Messrs. A. Pank & Son, Ltd.

HOOPER'S TELEGRAPH & INDIA RUBBER WORKS, LTD., has removed to Adelaide House, 5, Lower Ground Floor, King William Street, E.C.4.

MESSRS. WM. GEIPEL & CO. have been appointed agents for the United Kingdom for "Plania" carbons.

Catalogues and Lists.—MARSHALL ELECTRICAL CO., LTD., Tottenham Street, W.1.—A priced catalogue of electrical accessories—lampholders, switches, switch-plugs, &c.

MESSRS. JAMES KEITH & BLACKMAN CO., LTD., 27, Farringdon Avenue, E.C.4.—Two illustrated pamphlets dealing respectively with "K-B" steel-tube air heaters and cupola fans.

MR. ALAN WRIGHT, 124, Chancery Lane, W.C.2.—Pamphlets describing "Inventum" electric cisterns, and an adjustable meter bracket.

THE BOWEN INSTRUMENT CO., 9, Newton Road, Leeds.—Circulars Nos. C.30 and C.32, describing "Pyro" insertion and radiation pyrometers. Illustrated and priced.

BROOKHIRST SWITCHGEAR, LTD., Northgate Works, Chester.—A booklet entitled "Voltage Control on Loaded Distributors," dealing with the company's apparatus for this purpose. Also a pamphlet advertising "Cantie" switchgear.

MESSRS. HOLLINGS & GUEST, LTD., Thimble Mill Lane, Birmingham.—List No. A.102, containing illustrations, prices and details of hydraulic baling presses.

MESSRS. FALK, STADELMANN & CO., LTD., 83-93, Farringdon Road, E.C.1.—Publication No. P.1104, illustrating and describing the "Efesca" regenerative aerial tuner. Priced.

THE FORTIS REINFORCED CONCRETE SAFE CO., LTD., Thanet House, 231, Strand, W.C.2.—A leaflet advertising the company's safes and strong-room doors.

THE DAVIS FOUNDRY CO., Diamond Foundry, Luton, Beds.—Pamphlets advertising the "Revergen" gas-fired furnace.

THE EDISON SWAN ELECTRIC CO., LTD., 123-25, Queen Victoria Street, E.C.4.—A photogravure-illustrated folder, containing particulars of two of the company's new valves—the "G.P.4" and the "P.V.4."

THE CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, nr. Manchester.—A coloured poster (19 in. by 29 in.), advertising the company's high-tension accumulators for radio work.

MESSRS. CUTBILL, KING & CO., LTD., 32, St. Mary Axe, E.C.3.—An illustrated brochure describing the "Trident" electric boiler scaler.

THE BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2.—Three instruction pamphlets relating to the company's "B4," "B5," and "B6" radio valves. These sheets are packed with the valves and form a useful guide to their correct use.

Bankruptcy Proceedings.—FOSTER FRANK GREGORY, 2a, Westbourne Road, Luton, electrical engineer.—The public examination of this debtor was held recently at Luton. The statement of affairs showed liabilities of £575 against assets of £66. Debtor attributed his failure to insufficient capital and lack of business experience. On March 21st, 1924, he commenced business on his own account as an electrical engineer, with £5, his savings, and tools and implements valued at £20. He stated that he was greatly handicapped for want of capital, and borrowed about £80 from relatives which had not been repaid. He did not become aware of his position until an execution was levied against him on April 23rd.

C. J. NICHOLS, trading as C. J. Nichols & Co., 7, Park Street, Bridgend, Glam., electrical engineer.—The adjourned public examination of this debtor was held recently at the County Court, Bridgend. According to the statement of affairs, there was a deficiency of £1,308. Debtor stated that creditors had been pressing him for about two years. He admitted that he had continued trading after he was aware of his position in the hope that matters would improve. He commenced business in Bridgend in 1920 with £40 capital. Competition had been very keen, and he had been obliged to estimate for work at low figures. His largest contract had been for £2,158, and he had lost money on it. The examination was formally adjourned.

W. H. GREENALL, trading as the Hampton Electric Co., Newerne Street, Lydney, Gloucester, electrician.—The public examination of this debtor was held on June 22nd, at the Town Hall, Newport, Mon. The statement of affairs showed liabilities of £472, against assets of £65, leaving a deficiency of £407. Debtor attributed his failure to paying trade union wages and not getting value for his money. The examination was closed.

JAMES ANTHONY TREND, 31, Chapel Street, Luton, electrician.—The public examination of this debtor was held recently at Luton. The statement of affairs showed liabilities of £336, against assets of £460, or a surplus of £124. Debtor attributed his failure to loss on contracts. He stated that he became aware of his position in September last, since when he had contracted a few small debts.

C. E. F. PARKER, electrical engineer, Greendale, Privett Road, Gosport.—Last day for proofs for dividend, July 7th. Trustee, Mr. H. Ashton, Official Receiver, 87, High Street, Portsmouth.

J. RIGG and F. STEAD (Rigg & Stead), radio engineers, 17, Old Chapel Street, Blackburn.—First and final dividend of 2s. 4½d. in the £, payable at the Official Receiver's offices, 11, Winckley Square, Preston.

T. SCOTT and J. CAMPBELL (T. Scott & Co.), wholesale electrical suppliers, 42, Handyside's Arcade, Percy Street, Newcastle-on-Tyne.—Last day for proofs for dividend, July 10th. Trustee, Mr. R. W. Cave, Official Receiver, Pearl Buildings, 4, Northumberland Street, Newcastle-on-Tyne.

F. S. BOWEN (Manchester Electrical Maintenance Co. and F. Bowen & Co.), electrical engineer, 7, Brazennose Street, and 43, Thomas Street, Manchester. Trustee, Mr. R. R. Smethurst, 21, Spring Gardens, Manchester; released, June 1st.

T. ROBERTS and J. TAYLOR (Roberts & Co.), electrical engineers, 61, Old Town Street, Plymouth, and Fore Street, East Looe.—First and final dividend of 4s. 3d. in the £, payable July 6th, at 2, Courtenay Street, Plymouth.

A. THOMPSON (Arnold Electrical Co.), electrical and mechanical engineer, 38, Lucy Street, Hulme, Manchester.—Trustee, Mr. J. G. Gibson, Official Receiver, Byrom Street, Manchester, released June 16th.

D. C. BATE, electrical supplier, 16, John Dalton Street, Manchester.—Last day for proofs for dividend, July 7th. Trustee, Mr. J. F. Warburton, 28, Queen Street, Manchester.

C. MCMULLINS, electrician, &c., 9, Tanygroes Street, Port Talbot, Glam.—Receiving order made June 22nd, on debtor's own petition.

S. J. WATSON, lately carrying on business with H. Rothwell and F. C. Jinks as the Vulco Magneto Co., Ltd.—First and final dividend of 1s. 3½d. in the £, payable at Carey Street, W.C.

Company Liquidations.—GOODCHILD & PARTNERS, LTD., Eagle Street, Southampton Row, W.C.—Under the compulsory liquidation of this company accounts have been lodged showing unsecured debts of £5,149; preferential claims, £10; loans on debenture bonds, £2,000; assets valued at £1,729; and a deficiency of £23,030 with regard to contributories, the issued capital being £2,601 ordinary and £15,000 preference shares. Mr. G. D. Pepys, Official Receiver and Liquidator, reports that the company was formed in April, 1919, for the purpose of carrying on business as engineers' factors. In July, 1920, a subsidiary company called Stella Lights, Ltd., had been formed for the purpose of selling lamps on behalf of the Stella Lamp Co., Ltd. The arrangements with the latter company were not satisfactory and very little trade was done. In September, 1924, Stella Lights, Ltd., was revived for the purpose of selling radio valves and components, and in February, 1925, the selling of those components was transferred to Goodchild and Partners, Ltd. Mr. Goodchild states that the business carried on by Stella Lights, Ltd., from September, 1924, had greatly increased, and he expected a large volume of business in 1925. In point of fact, however, orders practically ceased after April, 1925, and the depression continued throughout the year. The failure of the company is attributed by Mr. G. W. P. Goodchild, whose business it was formed to acquire, to the false prosperity immediately following the war, which induced the company to extend its activities in the provinces; to the fact that shortly after formation of the company the market was flooded with surplus Government stores; to the general inactivity in the engineering trades since 1920; to price-cutting by some of the largest manufacturers; and to the slump in the radio trade which set in shortly after the company had entered it.

THOMAS WOOD & CO., LTD., electrical engineers, Cheadle, Manchester.—A meeting of creditors was held recently at the offices of Mr. G. H. Lawson, 14, Brown Street, Manchester. The statement of affairs presented showed liabilities of £506, all due to the trade. The assets were valued at £165. The company was formed about four years ago, on the laying of the electrical cable to Cheadle. There was very little local competition, but there was competition from Manchester by journeymen electricians, who accepted contracts at cut prices. The company, in an endeavour to keep local business, had been obliged to take certain contracts at cut prices. The deficiency account showed that up to October, 1923, there was a loss on the trading of £58, while since that date there had been further losses aggregating £156. A proposal was made that the managing director should buy back the assets from the liquidator. Eventually it was decided that a committee of three of the principal creditors should be appointed to act with the liquidator. The following are creditors:—

	£		£
Robinson, T. N.	85	Hurst, Ibbetson & Taylor ...	80
Baxendale & Co., Ltd.	57	British Thomson-Houston Co.,	
General Electric Co., Ltd. ...	31	Ltd.	32
Faulkner, J., & Co.	20	Wholesale Fittings Co., Ltd. ...	30

RE-ECHO RADIO CO., LTD., 109, Maraham Street, Horseferry Road, Westminster, S.W.1, manufacturers of receiving sets and accessories.—It is understood that the liquidator in the voluntary liquidation of this company, Mr. C. H. Whatley, accountant, 6-7, Charing Cross Chambers, Duke Street, Adelphi, W.C., is paying a first dividend of 2s. in the £ to the unsecured creditors.

POWER AND LIGHTING SUPPLIES CO., LTD.—Winding up voluntarily. Liquidator, Mr. A. T. Eaves 47, Mozley Street, Manchester. Meeting of creditors, July 6th, at the offices of the Liquidator. Particulars of claims by September 6th.

SOUTHERN RADIO SUPPLIES, LTD.—Particulars of claims by July 21st, to the Liquidator, Mr. P. M. Jones, Barclay's Bank Chambers, Terminus Road, Eastbourne.

COVENTRY WIRELESS SUPPLIES, LTD.—A meeting of members is called for July 27th, at Turnbull's Chambers, 14, High Street, Coventry, to hear an account of the winding up from the Liquidator, Mr. H. M. James.

RADIO PHONOPORE & ELECTRICALS, LTD.—First meetings of creditors and contributories were held June 30th, at Carey Street, W.C.

BRITISH BARIMAR-THERMIT WELDING CO., LTD.—A meeting of creditors was held on June 28th at the offices of the Liquidator, Mr. F. Rowland, 76, Finsbury Pavement, E.C. (This notice is purely formal, all creditors have been or will be paid in full.)

Private Arrangements.—THE COMTON WIRELESS MANUFACTURING CO., 26-28, Bartholomew Square, Old Street, London, E.C.—The adjourned meeting of creditors was held recently, at the offices of Mr. James Mortimer, accountant and auditor, 12, Coleman Street, E.C. Mr. Mortimer reported that since the creditors were called together on June 14th, the sheriff had sold stock by auction which had been seized under an execution. The stock so sold had realised £366, whilst there was other stock to the value of £50, making a total of £416. After allowing for costs, &c., the assets were estimated to realise approximately £400, and there were liabilities of £2,600. Mr. Mortimer added that unless the execution creditors were prepared to withdraw and instruct the sheriff to refund the money obtained from the sale of the stock there would be no alternative to the matter being dealt with in bankruptcy. He was instructed to state that if that course was agreed upon the assets would be distributed *pro rata* amongst the creditors, and in addition funds would be available to pay a further 1s. in the £ to the creditors. The matter was discussed at some length, but the meeting eventually broke up without any resolution being passed.

ACME PRODUCTION CO., LTD., manufacturers of electrical and radio wireless appliances, Birmingham.—A meeting of creditors was held recently, at Birmingham, when the chair was occupied by Mr. T. G. Weavers, 4, Drapers Gardens, E.C., who had been appointed to act as the receiver for the debenture holders. It was stated that the company was registered on May 12th, 1922, with a nominal capital of £3,000, and was formed to take over a business which had previously been carried on in partnership under the style of the Acme Production Co. It was then an electrical engineering concern, but later practically the whole of the attention of those interested was devoted to the radio business. No detailed statement of affairs had been prepared. A balance sheet prepared at the end of last March disclosed assets of over £5,000 against gross liabilities of £15,000. From time to time one of the directors advanced various amounts to the company to the extent of about £8,000. In April, 1924, a debenture was issued to a nominee of that director for £3,000, but during the current year the debenture had been transferred to another. A receiver was appointed owing to proceedings being commenced by a creditor. It was suggested that a new company should be formed to carry on the business, and that the liabilities should be paid in full out of future profits. The turnover for the fifteen months to March 31st last was approximately £9,000. The meeting eventually broke up without any resolution being passed.

Foreign Capital in Chile.—The *Board of Trade Journal* states that recent investments of foreign capital in Chile have not been very great, but both American and British financiers are showing a little interest. Recent developments include the new nitrate oficinas at Tocopilla and the Potrerillos copper mine, which involve the expenditure of some millions of pounds. A large British concern has just commenced work at Puente Cristo on the new £900,000 hydraulic power plant, and in addition there is the new lighting scheme and tramway improvement in Santiago. The installation of the automatic service by the Chile Telephone Company also involves large expenditure. Whether in connection with the investment of capital in development schemes or in the course of ordinary business, some of the largest British houses have shown far more interest in Chile during the last year or so than ever before, as is evidenced by the visits of special representatives.

Book Notices.—"Kelly's Directory of the Merchants, Manufacturers and Shippers of the World." (Two vols., 5,000 pp.) London: Kelly's Directories, Ltd. Price, 64s., post free.—This colossal work is now in its fortieth edition and contains the names of over 1¼ million business houses throughout the world, covering over 20,000 places. Apart from the particulars of companies, firms, and individuals, a great deal of miscellaneous commercial information is included which enhances the usefulness of the work. With the 1926 edition a *facsimile* page-proof is distributed indicating the immense amount of labour involved in keeping the directory up-to-date.

"Acid and Water Testing" (6 pp.).—This is an informative pamphlet issued by the D.P. Battery Co., Ltd., as an aid to those who have to deal with accumulators. Full details of a number of tests, and the apparatus required, are set forth.

"Commercial Art." Vol. I, No. 1. (48 pp.) London: The Studio, Ltd. Price 1s. net.—This new monthly, coming as it does from the offices of *The Studio*, fully reaches the standard of that journal. Many phases of "pictorial publicity" are treated in an interesting manner and the publication should prove of value to those interested in this new art.

"Selected Papers of the *Journal* of the Institute of Electrical Engineers of Japan." No. 10, April 26th. Tokio: The Institute.

United States Electrical Exports.—During April last the exports of electrical goods from the United States were valued at $9,070,500—the highest monthly total since May, 1921. The majority of the items showed an increase as compared with April, 1925. A notable rise occurred in the case of motors and electric locomotives, which were valued at $1,485,435 as against $808,166 in April, 1925. The exports of fans showed an increase of 68 per cent. Among the decreases were transforming and converting apparatus, switchboards, searchlights, domestic heating and cooking devices, meters and radio apparatus. For the first four months of the year the last item shows a total value of about $2,370,000, as compared with $2,710,000 for the corresponding period of last year.

The Latin-American Electrical Market.—The following notes are gleaned from a series of articles in a recent issue of *Commerce Reports*. The Brazilian market for electrical equipment shows an improvement and radio apparatus sales have also been slightly better recently and further improvement is expected owing to the advent of the opera season, and the reduction of prices. Among the principal imports into Bolivia during April were electrical supplies from the United

States and Great Britain, and mining machinery from these two countries and Germany. In Chile, sales of American electrical equipment are good but German and British firms report business as dull. The demand is largely for heavy apparatus. Recent important developments in Venezuela include the inauguration of a broadcasting station at Caracas and the awarding of a contract to an American firm for the establishment of a new electric light plant at Maracaibo.

Proposed Norwegian Tariff Changes.—The *Board of Trade Journal* reports that the Norwegian Government has prepared a Bill for the partial revision of the customs tariff. The articles affected by the proposals include electrical plug contacts and plugs therefor, the duty on which would be altered from 10 per cent. *ad valorem* to 30 öre per kg.; insulators of porcelain or other ceramic composition: High-tension, from 35 to 30 öre per kg.; low-tension, from 25 to 20 öre per kg.; arc lamp carbons, free (present duty 15 per cent. *ad valorem*); radio receiving apparatus, loud speakers, headphones and parts (not specified at present), 10 per cent. *ad valorem*; domestic heating and cooking apparatus (not specified at present), 5 öre per kg.; and copper cables (at present admitted free), 5 öre per kg.

New Italian Company.—A new company has lately been formed in Turin with a capital of 2 million lire and the title La Società Telefonica Interna Speciale, S.A.T.I.S., to manufacture telephonic apparatus.

Chinese Notes.—A new railless tramcar service was started in the International Settlement, Shanghai, on April 8th last. The Cie. Française de Tramways et d'Eclairage Electriques de Shanghai has decided to operate a railless traction service in the French Concession. The cars and equipment have been ordered from France and it is hoped to inaugurate the service in August.

The construction of tramways is in progress at Harbin and the cars and track material are being shipped from Germany. It is expected to have the system in operation early next year; in the meantime the motor 'bus concession has been extended.

The Superintendent of the Wireless and Long-Distance Telephone Services in North-East China has obtained the permission of the Mukden authorities to open these services to the public.

Lighting and Power Notes.

Australia.—SYDNEY.—The result of the first three months' (of this year) working of the electricity department is a net loss of £15,240, as compared with a net profit of £27,689 for the corresponding period of 1925. The erection of a new power house is proposed, at a cost of £5,000,000.

Ayr.—DISPUTE SETTLED.—An agreement has been reached between the Corporation and the Ayrshire Electricity Board in regard to items in dispute. Payments by the Corporation amount to £4,184 and by the Board to £2,805.

Bacup.—ELECTRICITY CHARGES.—Arrangements have been made with the Rawtenstall Corporation for a revision of the electricity charges in the district to come into operation in October.

Bathgate.—OVERHEAD TRANSMISSION.—The Town Council has granted an application from the Scottish Central Power Co. to build an overhead power line from the Balbardie steel works to the chemical works.

Bedford.—MAINS EXTENSIONS.—The Electricity Committee has authorised mains extensions at a cost of £8,500.

Bexhill.—APPLICATION FOR LOANS.—The Electricity Committee is to seek sanction for loans of £6,000 for mains, £5,000 for services, £3,000 for meters, and £5,760 for a new converter and switchgear.

Brighton.—LOAN SANCTIONED.—The Electricity Committee has obtained sanction to borrow £2,000 for the purchase of motors for hire.

MAINS EXTENSIONS.—The Electricity Committee has authorised mains extensions at a cost of £3,000.

Continental.—AUSTRIA.—The hydro-electric development in Austria increased from 170,000 h.p. in 1918 to 431,000 h.p. at the end of 1925. Some 15 stations, totalling 96,400 h.p., were still under construction in 1925.

LUXEMBURG.—Owing to certain defects the Compagnie Luxembourgoise d'Electricité has recently found it necessary to replace the old wooden-pole transmission line between Comblain and Bomal, a distance of about eight miles, by one with ferro-concrete masts.

Croydon.—COAL STORAGE SCHEME.—The Electricity Committee has recommended a scheme for coal storage and mechanical plant at the electricity works sidings at a cost of £2,000.

MAINS EXTENSIONS.—The Electricity Committee has authorised mains extensions at a cost of £1,000.

SUB-STATION SITE.—The Electricity Committee is acquiring a site at Orleans Road, Norwood, for the erection of a sub-station.

Dronfield.—BULK SUPPLY.—The Council has been informed that it is more advisable for Sheffield Corporation to supply electricity in bulk than for the Staveley Co. to do so, as the periodicity required (50) is Sheffield's figure, and that the maximum demand rate is preferable to the flat rate. The Council has decided to reply to the effect that it still prefers a flat rate, and has asked Col. Ekin to use his influence to get the Sheffield Corporation to make its offer as attractive as that of the Staveley Co.

Dundee.—LOAN PROPOSED.—The Electricity Committee has approved of a proposal to borrow £14,900 for the erection of three new sub-stations.

East Ham.—LOAN SANCTIONED.—The Electricity Committee has obtained sanction to borrow £5,000 for services.

Egypt.—HARNESSING THE JORDAN.—The Palestine Electric Corporation has been authorised to spend £2,000,000 in harnessing the falls on the River Jordan for the production of electrical energy.

Epsom.—APPLICATION FOR LOAN.—The Urban Council has applied to the Electricity Commissioners for a loan of £14,500 for the installation of two 300-kW Diesel sets and extensions.

Glasgow.—WIRING SCHEME.—During May 113 houses were dealt with under the Corporation wiring scheme, bringing the total up to 2,345.

DONATION TO RESEARCH.—The Electricity Committee has recommended that a donation of £100 be granted to the British Electrical and Allied Industries Research Association.

Hornsey.—LAND PURCHASE.—The Electricity Committee is purchasing land at a cost of £2,000 adjoining the electricity works in Tottenham Lane.

PRICE REDUCTIONS.—The Electricity Committee recommends that the additional charge of 10 per cent. over pre-war charges now in operation be discontinued from the date of the meter readings for the June quarter.

Ilford.—SUB-STATION SITE.—The Electricity Committee has obtained a site at the rear of the tramway yard for the erection of a sub-station.

LOAN SANCTIONED.—The Electricity Committee has obtained sanction to a loan of £2,000 for wiring installation.

Leigh.—YEAR'S WORKING.—We have received a copy of the report on the working of the electricity undertaking (engineer: Mr. J. B. Hudson) for the year ended March 31st last. The total income amounted to £43,248, as compared with £38,707 for the previous year. The working expenses totalled £27,125, against £21,639, leaving a gross surplus of £16,123 (£17,068). The deduction of capital charges resulted in a net profit of £4,474, as compared with £4,611 for the preceding year. The capital expenditure during the year amounted to £2,873, bringing the total investment up to £171,125. The kWh sold during the period under review amounted to 7,061,505, as compared with 4,752,349 for the previous year, and the average price obtained per kWh was 1.42d. (1.87d.). The maximum demand on the station was 3,880 kW, an increase of 1,230 kW on the figure for 1924-25.

London.—BATTERSEA.—*Loans Sanctioned.*—The Electricity Committee have obtained sanction for loans of £17,500 for generating plant, £2,420 for feeder cables, and £1,443 for connection and feeder pillars.

Sub-Station Extensions.—The Electricity Committee has decided to enlarge the Nine Elms sub-station and to install an additional 1,000-kW converter, at a cost of £9,500.

POPLAR.—*Increased Charges.*—The Electricity Committee reports that the coal dispute has increased coal prices, and will necessitate increased charges for electricity.

STEPNEY.—The Borough Council has received sanction to the borrowing of £165,000 for the following purposes:—E.h.p. and l.p. feeders, £75 000; distributing mains, £11,050; further provision for mains in streets not at present served, £33,950; services, £45,000.

Mansfield.—ASSISTED WIRING SCHEME.—The Town Council has arranged with local wiring contractors to carry out contracts for assisted wiring schemes at £7 to £7 10s. per house.

Newport (Mon.).—NEW SUB-STATION.—The Electricity Committee is to erect a sub-station in connection with the supply to the G.W.R.

Rothesay.—NEW POWER STATION.—The Electricity Commissioners have approved the erection by the Council of an electricity generating station.

Shoreham-by-Sea.—INAUGURATION OF SUPPLY.—An electricity supply for the district was inaugurated on June 25th. The undertaking is owned by the Shoreham & District Electric Lighting & Power Co., Ltd.

South Africa.—CAPE TOWN.—The Electricity Committee has decided to provide a sub-station and equipment at Woodscoat at a cost of £4,000.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Electrical Distribution of Yorkshire, Ltd., to supply electricity within the urban districts of Barkisland, Midgley, Rishworth, Scammonden, and Soyland, part of the urban district of Sowerby, the rural district of Todmorden, and the parishes of Norland and Upper Greetland; the Yarmouth (I.W.) Electricity Supply Co., Ltd., to supply within part of the rural district of the Isle of Wight; the Corporation of Lowestoft, to extend its area of supply so as to include the borough of Southwold, the parishes of Barnby, Blundeston, Carlton Colville, Corton, Flixton, Gisleham, Gunton, Kessingland, Oulton, Pakefield, Somerleyton, North Cove, Worlingham, Benacre, Covehithe, Frostenden, Reydon, South Cove, Walberswick, Wangford, and Wrentham; Messrs. Hunt

and Sons (Herne Bay), to supply within the urban district of Blean; the Corporation of Bristol, to extend its area of supply to include the parishes of Pucklechurch, Almondsbury, Olveston, Redwick, Northwick, Bitton, Hanham, Abbotts, Oldham, Syston, Kelston, and North Stoke.

The Minister of Transport has confirmed a Special Order made by the Electricity Commissioners authorising the Halifax and Huddersfield Corporations to give mutual assistance and to give and take a supply of electricity in bulk.

Swansea.—NEW FEEDER.—The Electricity Committee has decided to renew the feeder cable to Hafod at a cost of £2,000.

Thornbury.—OPPOSITION TO ORDER.—The Rural Council has decided to oppose the application of Bristol Corporation for an Order to extend its area of supply to the parishes of Almondsbury, Renwick and Northwick, and Olveston on the ground that it had previously resolved to support the proposals of the West Gloucester Power Co. in the Council's area.

Uruguay.—HYDRO-ELECTRIC PROPOSAL.—It is proposed to dam the Rio Negro and it is anticipated that this will effect a saving of about 900,000 tons of coal per year. The cost of the construction is estimated at 20,700,000 pesos (about £4,140,000).

Weymouth.—LOAN SANCTIONED.—The Electricity Committee has obtained sanction to borrow £6,000 for mains and services.

Tramway and Railway Notes.

Blackburn.—YEAR'S WORKING.—The annual report and statement of accounts for the working of the tramway undertaking (manager: Mr. James H. Cowell) for the year ended March 31st last, show an income of £113,156, as compared with £116,751 for the preceding year. The working expenses totalled £83,668, against £86,337, leaving a gross profit of £29,488 (£30,413). After the deduction of capital charges, a net surplus of £19,251 remained, against £20,127. The car-mileage for the year is recorded as 1,128,178, an increase of 11,719, and the number of passengers carried is shown as 16,994,833 (16,456,553). The kWh per car-mile amounted to 1.79, and the expenses per car-mile 3.13d. The capital expenditure for the year amounted to £6,387, making a total capital outlay of £367,905.

Continental. — SWITZERLAND. — *Railway Electrification.* — Work was completed last year on the electrification of a further 177 miles of the Swiss railways. A sum of £19,704,000 has so far been expended on railway electrification by the Swiss Government.

FRANCE.—The Paris suburban tramways are to be used during the night for the transportation of fresh vegetables and fruit from the outlying market gardens to the Central Markets.

Croydon.—THROUGH-RUNNING SCHEME.—The Tramways Committee reports that it will be necessary, if the L.C.C. through-running scheme is to be continued, to purchase 30 cars, at a cost of £80,000, sub-station plant at £14,000, feeders at £14,350, and shed accommodation, at a cost of £12,000.

Hull.—LABOUR PROTEST.—As a protest against the dismissal of tramwaymen after the general strike and the removal of two Labour members from the Tramways Committee, the Labour councillors have written to the Prince of Wales, stating that they will not take part in the social functions arranged for his proposed visit.

London.—CANNON STREET STATION.—Trial trains were run into and out of the reconstructed station on June 24th, and the station was reopened on June 28th.

MITCHAM.—Arrangements have been made by the South Metropolitan Electric Tramways Co. and the London County Council for cars to run through from the London termini to Cricket Green, Mitcham, *via* Tooting Junction.

TRAMWAY ACCIDENTS.—Statistics relating to accidents upon the systems of the Metropolitan Electric Tramways, Ltd., the London United Tramways, Ltd., and the South Metropolitan Electric Tramways and Lighting Co., Ltd., show that the total number of accidents for April, 1926, was 400, or 1.79 per 10,000 miles, against 397 for the corresponding period of last year, or 2.29 per 10,000 miles.

Oswaldtwistle.—TRAM FARES.—A deputation of the District Council has been appointed to wait on the Blackburn Corporation with regard to the cheapening of tram fares in the district.

Shields.—TUBE RAILWAY.—It is reported that the Ministry of Transport has approved a scheme, and is prepared, subject to certain protective clauses, to bring in a Bill authorising the construction of a tube railway under the River Tyne between North and South Shields. The scheme is being promoted by the Kearney High-Speed Tube Railway Co., and the cost is estimated at £300,000.

Telegraph and Telephone Notes.

India.—AUTOMATIC TELEPHONY.—The note under the above heading in this column of our June 18th issue appears to have conveyed an impression that was not intended. It referred, of course, to conditions which are alleged to exist in India, for automatic telephones are in use elsewhere with advantage and perfectly satisfactorily, no difficulty being experienced in their operation or maintenance. It would seem, however, that our correspondent has been misinformed, for we are given to understand that neither the Telephone Development Association nor the India Office, London, has any knowledge of the difficulties mentioned in the note, and we are asked to state that the Government of India has no intention of restricting the extension of automatic telephony in India.

New Admiralty Radio Station.—PLYMOUTH.—A powerful new wireless station, it is reported, is to be erected by the Admiralty at Devil's Point, Stonehouse, Plymouth. Work upon it will be begun at an early date, but its completion may take some time, inasmuch as no provision has been made for the necessary expenditure in the current naval estimates. When in working order the new station, it is understood, will supersede the existing one at Rame Head.

Radio-Telegraphy.—POST OFFICE SERVICES.—In a written reply to a Parliamentary question, the Postmaster-General (Sir W. Mitchell-Thomson) states that the total number of messages sent between Post Office wireless stations and ships during the year ended March 31st, 1926, was about 223,600, and the number sent from Post Office wireless stations to foreign countries was about 228,000.

Telephone Lines.—GRAMOPHONE CO.'S CONTRACT.—The General Post Office has granted the Gramophone Co., Ltd., a contract allowing it to make use of any land line which it may require in any part of the United Kingdom for the purpose of conducting sound waves to its recording studios from the inside of such places as Westminster Abbey and the Royal Albert Hall.

Turkey.—FRENCH RADIO COMPANY.—The Compagnie Générale de Telegraphie Sans Fil has concluded a contract with the Turkish Government for the erection of radio stations in Angora and Constantinople; the latter station is to be equipped with automatic receiving and transmitting apparatus. In both cities the stations will be of 15 kW, says *Commerce Reports*, which announces that the Electro-Radio Co. has been formed in Constantinople for the development of radio telegraphy. It has a 40-year concession, and will establish a factory in the city.

Radio Notes.

Alternative Programmes. — B.B.C. TEST. — The British Broadcasting Co., Ltd., carried out a test from its London stations between 11.15 p.m. and midnight on June 28th with the object of determining whether it is possible to provide two distinct programmes simultaneously at the same strength, but on different wave lengths. The Oxford Street (2 LO) transmitter worked on its normal wave of 365 metres at the same time as the stand-by plant at Marconi House in the Strand was radiating on 460 metres. The result of the experiment and the success of listeners-in separating the two stations will be judged from reports which listeners are asked to submit to the B.B.C.

Norway.—THE BERGEN STATION.—H.M. Consul at Bergen informs the Department of Overseas Trade that the new broadcasting station at Bergen is now working and the Broadcasting Company definitely formed. The station has been erected on the roof of the new telegraph building in the centre of the town; it is understood that the station has duplicate machinery and that it is intended to install one set at the Rundemand wireless station on one of the mountains near the town in order to see whether the results are better there. The present station may, however, be looked upon as permanent, and at present is working on a wave-length of 400 metres; the power is 1 kW, and the antenna about 30 metres long.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—August 23rd. Electricity Commission of Victoria. 10-in. disk suspension insulators. (See this issue.)

July 14th. Victorian Government Railways. A.c. power interlocking machine. (B.X. 2596.)*

September 1st. Automatic sub-station equipment for Elwood sub-station. (B.X. 2598.)*

August 11th. City Council. H. and l.p., 3-phase sub-station switchgear.*

August 3rd. Postmaster-General's Department. Telephones and dials.*

August 10th. Telephone exchange indicators. (B.X. 2597.)*

August 31st. Telegraph equipment. (B.X. 2653.)*

BRISBANE.—August 26th. City Electric Light Co., Ltd. One 12,500-kW turbo-alternator.*

Belfast. — July 31st. Electricity Department. One 15,625-kW turbo-alternator with condensing plant and auxiliaries, or, alternatively, one 18,750-kW turbo-alternator with condensing plant and auxiliaries. (See this issue.)

Croydon.—July 5th. Electricity Department. Electric locomotive coal-handling crane and grab and electric crane track. (June 25th.)

Dover.—July 19th. Electricity Department. Voltage regulator. (See this issue.)

Egypt.—CAIRO.—October 15th. Ministry of the Interior. Installation of electric power station equipment at Keneh and Luxor. (B.X. 2627.)*

July 10th. Director-General, State Domains Administration (Commercial Service), Savoy House, Qasr el Nil Street, Cairo. Three semi-Diesel engines and two centrifugal pumps.

August 2nd. Director-General, Mechanical Department, P.W.M., Cairo. 400-b.h.p. Diesel engine, driving an air compressor, together with auxiliary machinery.

Fife.—July 14th. Education Committee. Electric lighting installation at Cowdenbeath Secondary School. Forms from the Master of Works.

Glasgow.—July 9th. Corporation. Electric lighting, bells, and fire alarm installation, also cables for the Mearnskirk Sanatorium. Office of Public Works, 64, Cochrane Street.

Grimsby.—July 10th. Electricity Department. L.p. cables for one year. (See this issue.)

Huddersfield.—July 7th. Electrician's work in connection with the conversion of premises, St. George's Square and Station Street, into shops for the Huddersfield Building Society. Particulars from Messrs. Stocks, Sykes & Hickson, architects, St. Peter's Street, Huddersfield.

India.—July 16th. India Store Department. 500-kW rotary converters with step-down transformers.. (June 25th.)

July 16th. Coal- and ash-handling plant for power station. July 30th. Steel-frame buildings and overhead electric travelling crane. August 6th. Complete boiler-house equipment or, alternatively, complete boiler-house installation, including pulverised-fuel equipment, &c. Particulars from the Department, Belvedere Road, S.E.1.

August 9th. Electrical generating plant for Peshawar power station of the North-Western Railway. (B.X. 2644.)*

London.—BERMONDSEY.—July 15th. Borough Council. Electrical installation for lighting, heating, and power at the baths and washhouses, Grange Road. (June 11th.)

LONDON COUNTY COUNCIL.—The Education Committee recommends that tenders for electrical work at the Frankham Street school, Deptford, be invited from selected firms of contractors.

Manchester.—July 7th. Electricity Department. Two 130,000-lb. water-tube boilers, flues, coal chutes, ash hoppers, pipework, valves, induced- and forced-draught plant and chimneys, one 40,000-kW turbo-alternator, with condensing plant, &c. (June 4th.)

July 5th. 33,000-V trunk feeders, pilot cables, and telephone cables. (June 11th.)

New Zealand.—CHRISTCHURCH.—October 19th Christchurch Drainage Board. Three sets of electric centrifugal pumping plant. (A.X. 3215.)*

WELLINGTON.—August 24th. Public Works Department. Synchronous condensers for the Waikaremoana electric power scheme. (B.X. 2608.)*

July 20th. Phase transformer for Mangahao electric power scheme.*

August 30th. 400-V, 3-phase, slip-ring induction motors and starters.*

September 28th. Three electrically-driven low-lift pumps, with control apparatus, for the Taleri drainage. (A.X. 3274.)*

November 2nd. Electric generators and turbines for Waikaremoana electric power scheme. (B.X. 2622.)*

September 7th. Synchronous condenser for the Arapuni electric power scheme. (B.X. 2654.)*

August 10th. Postmaster-General's Department. Dry cells. (B.X. 2649.)*

Newmilns (Ayrshire).—July 12th. Town Council. Electric lighting installation at six blocks of houses. Specification from Mr. J. H. Gilmour, burgh surveyor.

Normanton.—July 5th. Urban District Council. 1,400 yd. feeder cable. (June 18th.)

Nottingham.—July 6th. Electricity Department. Twelve months' supply of general stores. (June 18th.)

Plymouth.—July 15th. Electricity Department. Three-phase transformers and sub-station e.h.p. switchgear. (See this issue.)

Saffron Walden.—July 24th. Borough Council. Engine and dynamo, switchgear, booster balancer and battery, accumulator battery, and mains. (See this issue.)

South Africa.—July 8th. South African Railways and Harbours. Telegraph material, poles, cross arms, &c. (A.X. 3173.)*

August 12th. Electric cables and wires and bare copper wire (for 12 months). (B.X. 2639.)*

JOHANNESBURG.—July 29th. Municipal Council. Transformers. (B.X. 2636.)*

Uruguay.—MONTEVIDEO.—July 6th. State Electricity Works. 1,000,000 metres of insulated conductors. (B.X. 2523.)*

July 9th. 137,500 metres of rubber-insulated wires and cables. (B.X. 2548.)*

40,000 metres of coloured twin conductor cords. (B.X. 2549.)*

July 22nd. 35,000 electric lamps.*

Warrington. — July 20th. Electricity Department. Twelve months' supply of e.h.p. and l.p. paper-insulated and lead-covered cables. (See this issue.)

Waterford.—July 29th. Borough Council. E.h.p. overhead lines distribution network and street lighting system. (See this issue.)

Wigan.—July 5th. Corporation. Electric lighting installation at Whelley new schools. Specification from Borough Electrical Engineer.

Wolverhampton.—July 10th. West Midlands Joint Electricity Authority. Two turbo-alternators, condensing plant, &c., for Birchills power station. (June 18th.)

July 24th. West Midlands Joint Electricity Authority. Three steam boilers, pulverised fuel plant, ash- and coal-handling plant and boiler-house auxiliaries, for Birchills power station. (June 25th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia.—SYDNEY.—From various newspaper reports that are to hand by the last mail, we read that the City Council, on May 11th, unanimously agreed to accept the tender of the Metropolitan-Vickers Co., Ltd., for 33,000-volt switchgear for the Bunnerong power house at £104,693 (total £106,038), although Messrs. Ferguson, Pailin, Ltd., had tendered about £7,000 less. The Metropolitan-Vickers Co. also received a contract for armour-clad switchgear for step-down sub-stations, at £203,069, of which £162,000 worth will be manufactured in Australia. With reference to the first of the above contracts, Messrs. Ferguson, Pailin had asked that, before either tender was accepted, a committee of independent expert engineers should be appointed by the Council to inquire into statements that had been made by Mr. Maling, the acting general manager of the Electricity Department. They added: "Failing the granting of this request, we regret that it will be necessary for us to take other action, but we are determined to have justice in this matter. Your Council is not aware, probably, that we were not granted an opportunity of discussing our tender with your officers, whereas such opportunity was given to the majority of the other tenderers." As we stated in the ELECTRICAL REVIEW for June 4th, p. 838, the decision regarding the matter was deferred until the Council could obtain the opinion of Mr. Forbes Mackay, the general manager, who was in England. One of the reports now to hand states that Mr. Mackay cabled out to say that in his opinion the Metropolitan-Vickers gear was worth the higher price.

At a special meeting of the Council, the tender of the Commonwealth Shipping Board for a mechanical draught plant for the Bunnerong power house, at £99,898, was accepted.

New South Wales Railways.

One 20,000-kW turbo alternator (£67,882).—C. A. Parsons & Co., Ltd. —*Tenders.*

Postmaster-General's Department.

11,000 yd. 7-pair conductor cable (£428).—Lawrence & Hanson Electric Co.

768 strips of fuse mountings (£708).—Phœnix Telephone and Electric Works, Ltd.

885 strips of protectors (£1,423).—New System Telephones, Ltd.

Motor-generator set, with spares (£1,634).—Newton Bros. (Derby), Ltd.

Loading coil cases (£2 101).—Standard Telephones & Cables (Aust.), Ltd.

MELBOURNE.—Federal Capital Commission.

Special electric light fittings for Parliament House, Canberra (£1,876). —Australian General Electric Co.

Barnsley.—Town Council. Accepted:—

Duplicate of the existing electrically-driven turbine boiler feed pump (£295).—Mather & Platt, Ltd.

Dundee.—According to the *Dundee Courier*, the Electricity Committee last week had under consideration contracts for the supply of cable. In addition to British offers, tenders were submitted from German and Dutch firms, the German quotation being from 7 to 21 per cent. below those of British manufacturers. It was decided that out of six offers, three by British makers should be accepted, and that in the other three cases, where the British tenders were in the region of 20 per cent. higher, the German offers should be accepted. The lowest combined British quotations totalled £1,621, and the lowest foreign £1,278, a difference of £343.

Corporation. Accepted:—

Electric lighting installation at 120 Corporation houses (£955).—J. Davie

Edinburgh.—Following up our brief mention of the turbo-generator contract in our last issue, we learn that the Electricity Committee on Tuesday last week decided to give a contract for the installation of two 25,000-kW turbo-alternators at Portobello power station to the British Brown Boveri Co., whose price was £138,000, as against £190,708 quoted by Messrs. Parsons and Co., the lowest British offerers.

The placing of the contract has been under consideration for some time. At a previous meeting the Committee had before it a report by the engineer on the tenders, when it was found that the lowest had been submitted by the British Brown, Boveri Co. The price quoted was £76,500 for one machine, while the lowest price quoted by a British firm was £98,903 by the British Thomson-Houston Co., Ltd. In its desire to keep the contract in this country, if possible, the Committee decided to ask the British firms to requote. At last week's meeting it was reported that all the British

firms had reduced their prices by an amount equal to 12½ per cent. on the turbine and alternator only, the condenser prices remaining unaltered. It was also stated that the British Brown, Boveri Co. had further reduced its price by £7,500, so that the difference between its offer and the lowest British tender for the one machine amounted to £26,354. The Committee agreed to purchase two machines and to accept the offer of the British Brown, Boveri Co. The firm guarantees that 35 per cent. of the money will be spent in Britain, and that the condenser will be made by a British maker. The firm built the first three 10,000-kW sets installed at Portobello.

Glasgow.—Tramways Committee. Recommended:—
Steel tires.—Steel Co. of Scotland, Ltd.
Axles.—Glasgow Railway and Engineering Co., Ltd.
Commutators.—G. Gordon & Co.
Points and crossings.—Hadfields, Ltd.
Resistances.—Electro-Mechanical Brake Co., Ltd., and Traction Equipment Co., Ltd.

Hornsey.—Electricity Committee. Recommended:—
Cables for 12 months.—Standard Telephones & Cables, Ltd.
Conduits for 12 months.—Albion Clay Co., Ltd.
Repairing coal bunkers (£128).—J. B. Gapp & Co.
Pipes for condenser and cooling tower (£945).—Dilworth & Carr, Ltd.

Education Committee. Recommended:—
Installation of electric lighting at Campsbourne school (£265).—Southey and Co.

Hull.—Telephone Committee. Accepted:—
Extension of the automatic telephone system (£38,525).—Standard Telephones & Cables, Ltd.

Ilford.—Electricity Committee.
Automatic apparatus at Goodmayes sub-station:—

Metropolitan-Vickers Electrical Co., Ltd.	£3 253
Crompton & Co., Ltd. (Recommended.)	**2,900**

Equipping 500-kW converter with semi-automatic control at Grove Road station (£227).—Metropolitan-Vickers Electrical Co., Ltd.

Irish Free State.—DUBLIN.—The following contracts were placed by the Controller of Stores (Posts and Telegraphs) from April 23rd to May 22nd:—
Electric lighting cable.—Dennis & Co.
Induction coils.—International Electric Co. Ltd.
Repeating coils.—Standard Telephones & Cables, Ltd.
Insulator rings.—Avon India Rubber Co., Ltd.
Telegraph accessories.—Creed & Co., Ltd.
W/t accessories.—Marconi (Ireland), Ltd.
Telephone accessories.—North British Rubber Co., Ltd.; Peel-Connor Telephone Works.
Flame-proof wire.—Suddeutsche Kabelwerke.
—*Irish Electrician.*

Commissioners of Public Works.
Electric lighting installation at the hospital block, Cork Military Barracks.—Nolan Bros. —*Irish Builder and Engineer.*
Installation of vacuum-cleaning plant at the G.P.O., Dublin.—Sturtevant Engineering Co., Ltd.

Lamp Contracts.—The British Thomson-Houston Co., Ltd., has received a 12 months' contract for "Mazda" incandescent lamps from the Royal Mail Steam Packet Co., Ltd., and its contract for lamps with the Pacific Steam Navigation Co. has been extended for a period of six months.

The Edison Swan Electric Co., Ltd., has received a contract from the General Post Office for carbon-filament lamps.

Leicester.—Electricity Committee. Recommended:—
Condensing plant at central generating station (£14,765).—Worthington-Simpson, Ltd.

Sewage Committee. Accepted:—
Switchgear for sluice valves at Abbey pumping station (£1,812).—Blakeborough & Sons.

London.—LONDON COUNTY COUNCIL. Education Committee.
Installation of electric lighting at Alton Street school, Bow:

A. Hawkins & Sons. (Accepted.)	**£549**
Davis, Lawrence & Co.	562
Burdette & Co., Ltd.	564
Ohms (Bovis, Ltd.)	567
G. A. Weston	585
H. W. Hives	631
A. Dean & Co., Ltd.	663
Barrett & Wright, Ltd.	673
Jenner Light & Power Co., Ltd.	700
Electrical Contracts and Maintenance Co. (1925), Ltd. ...	708
Bailey & Incledon	745
Hawkhall Garage	748
Morris Electrical Co., Ltd.	762
Eastern Armature Winding Co.	779

METROPOLITAN ASYLUMS BOARD.—Works Committee.
Electric light installation in hut buildings, Pinewood:—

P. M. Braidwood. (Recommended.)	**£172**
C. F. Williams	175
T. H. Buxton	232
Lowke & Sons, Ltd.	248
Brightside Foundry & Engineering Co., Ltd.	280
Blackburn, Starling & Co., Ltd.	282
J. Briggs & Co.	290
Anderson, Angell & Co.	296
Bailey & Incledon	311
Read & Partners, Ltd.	324
Springvale Electrical Co.	329
Coley & Swinnerton, Ltd.	335
A. E. Moreland	346
Hopkins Bros.	350

STEPNEY.—Electricity Supply Committee.
100 cast-iron chambers, frames, and covers (£184).—E. & F. Wright. (Recommended.)

Wiring Carter House, Butler Street:—

L. G. Tate & Co. (Recommended.)	**£411**
Barlow Bros. & Co.	444
Duncan Watson & Co.	491
Ellis & Ward, Ltd.	492

Mansfield.—Town Council. Accepted:—
2,400 yd. of h.p. cable.—Standard Telephones & Cables, Ltd.

Preston.—Tramways Committee. Recommended:—
Double-decker tramcar (£2,185).—English Electric Co., Ltd.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

Live SPARKLET high-tension fuse.

Notes.

Royal Air Force Display.—The Marconiphone installation which is to be used at the pageant on July 3rd, consists of 20 loud-speakers which necessitate the use of 100 valves and 14 miles of wire. There are 13 banks of high-pressure batteries, each of 350 volts, and the feed current in the power banks will be 1.1 amp., the high voltage being 2,460 V. "Exide" type-WH batteries are used, made up in 24-volt units of 5,000 milli-ampere-hour capacity; this type of battery is used exclusively by the Marconiphone Co. for all "Public Address" work.

A Novel Electric Heating Installation.—A recently installed electric heating system at the Leather-Sellers Alms Houses, High Barnet, has some interesting features. The work is arranged on the "Tabernacle" system of Messrs. Bastian and Allen. In consequence of the limited space and the necessity for economy, the heaters are placed in a floor troughing on each side of the aisle. Six different heats are provided, and each is under an independent control, so arranged that the distribution of heat is equal in all cases.

Accidents in Switzerland.—The Swiss High-Voltage Electricity Inspectorate, of Berne, reports that 62 accidents occurred in connection with high-pressure electricity undertakings in Switzerland during last year, as against 66 in 1924. Sixty-six persons were injured, eighteen fatally, as compared with 62 and 26 respectively in the preceding year. The report adds that the official inquiries into the accidents showed that inattention and carelessness were the principal causes, although four of the cases were due to the use of unsuitable inspection lamps.

Diesel-Electric Railway Engine.—Some particulars are given in *Power* of a Diesel-electric machine which is to drive one or two cars which have been ordered by the Swiss Federal Railways for use on the non-electric portion of the Swiss system. The plant consists of a 250-h.p., 4-cycle, solid-injection Diesel driving a 750-V d.c. generator. The engine has eight cylinders, arranged V-fashion in two rows and runs at 550 r.p.m. An exciter, which is belt-driven from and set above the generator, is also used as a starting motor, energy being supplied from a storage battery.

Tasmanian Hydro-Electric Scheme.—According to the *Australasian Electrical Times*, an interesting hydro-electric scheme is under consideration in Tasmania. The scheme, proposed by Mr. W. E. Shoobridge, provides for the damming of the River Derwent at its junction with the Guelph, to hold water as a reserve to the main source of supply, Lake St. Clair. It is also proposed to erect a hydro-electric plant capable of producing 90,000 h.p. at the junction with the River Florentine, 75 miles from Hobart. A portion of the water passing over the turbines would be diverted into channels and utilised for irrigation purposes, the remainder being carried away to augment the present insufficient water supply in Hobart. It is proposed to convey the water in an open channel from Lake St. Clair to a point opposite the junction with the Florentine, where it will be passed through pipes falling 1,650 ft. to the power house. The cost of the power station and pipe line is estimated at £1,500,000.

Appointments Vacant.—Station superintendent for Heston and Isleworth U.D.C. Electricity Department. Three sub-station engineering assistants; two overhead mains engineering assistants and two meter and testing assistants (salary 350 taels per month for each appointment, tael=3s.); electrical engineer and manager for the Launceston and District Electric Supply Co., Ltd. (See our advertisement pages to-day.)

Manchester Municipal College of Technology.—The prospectus giving particulars of the courses in Mechanical, Electrical, Municipal and Sanitary Engineering, Chemical and Textile Technology, can be obtained free on application to the Registrar, The College. (See our advertisement pages to-day.)

Large Gas-Engine Plant.—In the course of his presidential address to the Society of British Gas Industries on June 23rd, Sir Alfred Mond mentioned that the Staveley Company had recently installed at its Chesterfield works a Cockerill gas engine and alternator of 5,000-kW capacity working on blast-furnace gas. This, he said, was the biggest gas engine put down in this country, and two others were being built for the same company, the installation costing less than a modern steam-turbine-electric plant, and being more efficient. This showed that the big gas engine was by no means out of the running in the race for cheaper power production. The new president, Lord Ednam, said that he had been to the United States to study the process of low-temperature carbonisation invented by Mr. McEwen; the first full-size plant had been erected there and was doing well. He thought it would prove a valuable aid towards the solution of the coal industry's position in this country.

Country Mansion Fires.—This subject was discussed at the recent annual conference of the Institution of Fire Engineers in London. In the course of a paper Chief Officer T. Breaks, Sheffield City Fire Brigade, pointed out that: "Much has been said about the dangers of electric light, and unfortunately many fires which have occurred have been attributed to these simply because no other likely cause could be traced. I think the majority of those present at this conference will agree with me when I state that of all artificial methods of obtaining illumination, electric light is far and away the safest, providing always that, in the first place, it is installed with due care by a reliable firm of electrical engineers, and that any extensions, alterations, or repairs are carried out by competent workmen.

"Every electrical installation should be subject to test and inspection at intervals by a qualified person, and any defect remedied. As regards actual fire risk, in most cases electricity is not at fault, but it must be remembered that the rubber insulation with which the wires are covered perishes, or becomes brittle with age, and that many houses are wired on obsolete systems, such as with wooden casing.

"When this state of affairs prevails, the rubber is no longer a protection against damp, which may result from condensation on change of temperature, or leaking through roofs or from water pipes. I repeat, therefore, it is very necessary that old installations should be opened up for expert examination, as an insulation test, which may show absence of leakage for the moment, is not sufficient to ensure security on circuits with perished insulation."

In conclusion he states: "It seems almost superfluous to urge the necessity of a means of telephonic communication with the nearest efficient fire brigade. The telephone instrument in the house should be fixed in such a position that it is not readily put out of action by any fire which may occur, a most suitable position being near a window on the ground floor, in order that the window may be broken in case of necessity, and the telephone used from outside. The wiring for the telephone should be as short as possible inside the house, as the less exposed wire there is, the more remote is the likelihood of its becoming damaged at the commencement of a fire.

"The subject of telephones and the calling of the brigade brings me back once more to what I consider the crux of the whole question of the total destruction of country houses by fire, which is that foresight should be exercised by the owners, and arrangements made with an efficient fire brigade for their services in case of emergency."

Mr. S. G. Gamble (late second officer of the London Fire Brigade) said that he believed electricians were coming to the conclusion that the life of the majority of electrical installations was 15 years. Wandering leads, especially when in a position to get chafed, were a great danger.

[The desirability of the periodical inspection of old installations cannot be questioned, but whether their "life" is no more than 15 years is a matter of opinion. Perhaps correspondents will give us the benefit of their experience.—EDS. ELEC. REV.]

An Electric Baking Installation.—The accompanying illustration shows the electric baking apparatus which has been installed at the premises of Messrs. Rayner, Ltd., by the General Electric Co., Ltd. The installation consists of two units, one double-tier and one single-oven, each with a capacity of half a sack of bread per hour. Each compartment of the double tier unit has an area of 4 ft. by 4 ft., and will accommodate 126 meat pies or 162 sausage rolls per charge. Each batch takes 20 min., the oven working at a temperature of

An Electric Bakery.

420-450 deg. F. The total output for a 48-hour week is 18,000 meat pies and 22,800 sausage rolls, the energy cost being 48s., at 1d. per kWh. The second unit is used for bread only and has a normal capacity for 4,500 half-quartern loaves per week. A test showed that the energy cost for this output amounted to 44s. per week at 1d. per kWh.

Extensions at the United Alkali Co's Works.—On June 22nd, Sir Max Muspratt, chairman of the United Alkali Co., Ltd., accompanied by the directors, visited the West Bank power station, Widnes, to inspect and put into commission the new 10,000-kW turbo-alternator and condensing plant recently supplied by Messrs. Metropolitan-Vickers Electrical Co., Ltd. This plant has increased the total capacity of the station to 20,000 kW. Although the station is primarily used for the generation of energy for the company's works, normally operating at a load factor of over 90 per cent., it is interlinked with the Mersey Power Company's undertaking. The new set generates three-phase energy at 6,600 V, 50 periods, 0.8 power factor, and runs at 3,000 r.p.m. The turbine is a two-cylinder machine, and is fitted with an integral-type feed heater for two-stage bleeding. The condenser is of the central-flow divided-surface type, capable of maintaining a vacuum of 28.5 in. with cooling water at 65 deg. F. on a load of 12,500 kW. The auxiliary plant comprises a steam-operated air ejector of the two-stage surface intercooled type, and an electrically-driven hot-water extraction pump. The station is favourably situated for condensing water and the capacity of the pumping plant has been increased by the installation of a Mather & Platt vertical "Lonovane" pump of 13,500 gal. per min. capacity. The extensions also include 6,600-V switchgear (Metropolitan-Vickers) for controlling the new generator, and additional feeders have recently been laid by the British Insulated Cables, Ltd.

Submarine Cables at Lowestoft.—One of the problems to be solved by the distributing engineer is that of "crossing the river," and each locality has its own peculiar difficulty and special interest in this connection. We are indebted to

Laying Cables Across Lowestoft Harbour.

Mr. Wm. R. May, borough electrical and tramway engineer, Lowestoft, for the accompanying illustration, which shows the operations at the harbour, across which 12 cables (8 l.p., 2 e.h.p., and 2 pilot) were laid in a trench dredged 7 ft. deep in the harbour bed. The cables were laid at or near low tide, during three consecutive tides, the time available for work at each varying according to the rate of flow of the water, and being from two to four hours.

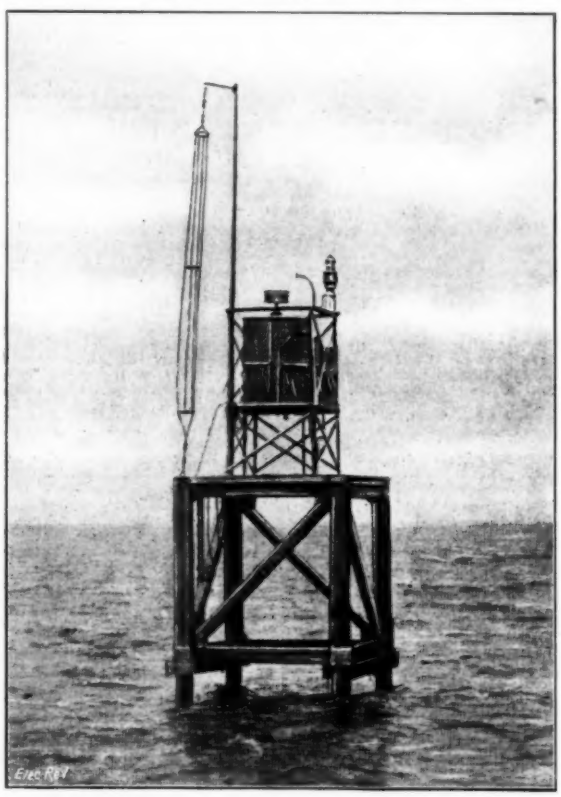
Congress of Chemists.—The 45th annual meeting of the Society of Chemical Industry, and the Congress of Chemists are to be held in London from July 19th to 23rd inclusive. One of the most interesting items will be a symposium on corrosion, July 20th. A visit to the Osram Robertson Lamp Works, Hammersmith, of the General Electric Co., Ltd., has been arranged for July 21st, and an exhibition of chemical plant has been arranged for at the Central Hall, Westminster, from July 19th to July 24th. Full particulars can be obtained from the General Secretary, Society of Chemical Industry, Central House, Finsbury Square, London, E.C.2.

A Furnished House as Prize.—A competition, somewhat similar to that which is in preparation by E.D.A., is being organised by the *Sunday Chronicle* in which the prize will consist of the freehold of a new house, completely furnished and decorated as the winner may decide. The site is in Kingsbury, on the north-west outskirts of London. Sir Reginald Blomfield, R.A., the architect, has designed the house on Georgian lines; the building will be entirely of concrete. When finished, the house will be thrown open to the public, unfurnished and undecorated, and visitors will be invited to submit

schemes for the decoration and furnishing of the house. The person whose scheme is adjudged the best will receive the house completed, fitted and furnished as suggested in his scheme. Here is an opportunity for acquiring an all-electric house on easy terms!

Magneto-cohesion.—Further applications of the magnetic drum principle using the magneto-cohesion effect described in a former I.E.E. paper are treated in detail in the June issue of the I.E.E. *Journal*. Mr. N. W. McLachlan, D.Sc., describes a new form of siphon recorder, with a very small transit time, for high-speed radio-telegraph reception on commercial circuits (beam stations). The shoe of the recorder is of special construction and the operating force for a current of 4 mA is about 4 lb., which is extremely large for a recording instrument. Owing to the rapidity of motion of the siphon lever it is possible to secure legible tape records when atmospheric disturbances are neither too severe nor too frequent. The procedure adopted in reading and transcribing messages at the central receiving station is outlined and other applications of the magnetic drum principle to a delayed-action relay and to the checking of clocks by wireless signals are described. The thermionic valve circuits associated with the various devices are discussed and portrayed diagrammatically

Wireless Fog Signals.—An installation of great interest to those concerned with harbour administration is referred to in an official notice to mariners which announces that an unattended fog signal has been permanently established on Rosneath Beacon in the Firth of Clyde. The installation was put in for experimental purposes in January of this year, and the trials since carried out under actual working conditions have been so successful that a prolongation of the trial period is now considered unnecessary. Installations of this kind render possible the erection of unattended lighthouses and fog signals at many difficult situations where it is at present too expensive to provide light keepers, or to maintain a submarine cable connection for an unattended light or fog signal. The installations on the Clyde were designed under the direction of



Unattended Fog Signal Station on the Clyde.

Messrs. D. & C. Stevenson, Edinburgh; the wireless apparatus was supplied by the Marconi Company; and the fog guns by Messrs. Moyes, Glasgow. The signals are automatic in action, the explosions being obtained from a mixture of air and acetylene gas. The two guns on the Clyde have a system of wireless receiving apparatus fitted to them and a transmitting set synchronising with the receiving sets is installed at Gourock Pier, 1¼ miles from Rosneath Beacon. When fog is observed the transmitting installation is put into operation and the impulses sent out are received on the apparatus attached to the fog signals which starts them. The synchronising arrangement renders the installations immune from "atmospherics" and interference from other wireless waves. Sufficient energy is got for the transmitting and receiving installations from small storage batteries. The essential features of the transmitter are a pendulum, a spark coil, and a quenched-spark transmitter. The pendulum is allowed to swing freely, causing a small contact on its side to dip into a mercury cup a predetermined number of times per minute; the coil circuit is then closed and consequently trains of waves are radiated at the fixed rate per minute; after a specific number of trains has been transmitted, the gas valve of the gun will open, and the gun will fire. For stopping the gun the transmitter sends out trains of waves at a different frequency. The special Marconi dull-emitter valves give constant emission with a consumption of 0.06 ampere per filament; they are lighted permanently and are changed every three months. The first is a detector, the second a low-frequency amplifier, and the third and fourth valves perform a special duty in connection with the moving-coil relay which controls a local battery circuit through two balance wheels. The signals from the transmitter cause the relay contacts to open and close once for each swing of the pendulum, and the amplitude of the swing of the start balance wheel increases continuously, while the start pendulum is in operation until contact is made. The battery then sends a current through another relay which opens the gas valve. The receiver is completely self-contained and needs attention only once in three months for battery charging and valve replacement.

"Recently there have been notable proofs of the value of radio bearings in navigation," says a Lighthouse Service Bulletin issued by the United States Department of Commerce, which recalls the fact that the rescue of the crews has been made possible by the fact that the rescue vessels carried wireless direction finders.

In the United States 24 radio-beacons are now in operation and there are about the same number on the coasts of other countries. New ones are being installed at several United States ports and in Alaska and the Hawaian Islands. A few months ago seven radio-beacons were established on the Great Lakes and the appreciation of their value by shipping interests is shown by the fact that a considerable proportion of Lake vessels are being equipped with wireless direction finders. In a short time a low-power radio beacon will be installed on Long Island Sound.

Flameproof Electrical Apparatus.—In paper No. 21, "Flameproof Electrical Apparatus for use in Coal Mines," by C. S. W. Grice and R. V. Wheeler, issued by the Mines Department, Safety in Mines Research Board (H.M. Stationery Office, 1s. 3d. net), an account is given of experiments carried out and the conclusions drawn by the authors on the cooling of hot gases during their passage through perforated plates. In experiments with brass plates having either single holes or a number of symmetrically spaced perforations, it was found that, unless the plate was at least ¼ in. thick, cooling mainly by expansion was unable to secure safety and at the same time afford adequate release of pressure. If, however, the plates were of that thickness, the open area could be increased and the release of pressure thus accelerated. With regard to the perforated plate it is concluded that the area of each perforation is, in general, of more importance than the total open area of the plate, more particularly in the case of thin plates (¼ in. or less). As the thickness of the plate is increased the effect of the size of the perforations is diminished. In dealing with the enclosure it is concluded that the area of the aperture in an enclosure covered by a perforated plate required to combine safety with adequate release of pressure is ¾ sq. in. per litre of explosive mixture within the enclosure. One sq. in. per litre (28 sq. in. per cu. ft.) can be taken as providing ample margin of safety. From the results of the tests the following specifications have been drawn up for perforated plates to afford satisfactory protection against the passage of the flame of the most explosive mixture of methane and air:—

Dia. of hole.	Thickness of plate.	Number of holes.	Total open area per plate.	Max. pressure developed within enclosure.
4/64 in.	¼ in.	37	0.114 sq. in.	62 lb. sq. in.
4/64 in.	¼ in.	148	0.454 sq. in.	25.7 lb. sq. in.
4/64 in.	¼ in.	329	1.010 sq. in.	nil.

Of commercial perforated metal, no type of sheet was found to prevent an external ignition under all conditions of test when a single thickness was used, but four types were found to be satisfactory when used double. At least two sheets must be used, one above the other, each having an area of 1 sq. in. per litre of enclosed explosive mixture. They can be separated by 3/16 in. Rapid release of pressure is afforded by this arrangement; the ingress of dust can be prevented by superposing a sheet of lead foil 0.005 in. thick which can be protected by a grid of thick wire.

Diesel Engine Users' Association.—At the well-attended June meeting of the Association, a paper by Mr. J. E. Hackford on "Some Deleterious Properties of Lubricating Oils" was read and discussed. The author did not minimise the value of the evidence furnished by the usual type of chemical analysis, but he stated that, given two oils of approximately the same chemical analysis, one oil would often give better results in practice than the other. It might be assumed that lubricating oils possessed certain inherent deleterious features which, like bacteria, might remain quiescent in the newly-manufactured material; after the oils had been used as lubricants, however, the deleterious features developed and, in time, rendered them unfit for further use. Correctives might be applied and the oils restored to a more or less satisfactory condition.

Civil Service Commission.—Regulations, particulars, and forms of application for the forthcoming examination for probationary assistant engineers in the Engineering Department of the General Post Office can be obtained from the Secretary, Civil Service Commission, Burlington Gardens, S.W.1. Latest day for the receipt of application forms, August 19th. (See our advertisement pages to-day.)

Industrial Standardisation in Sweden.—The State subvention of Kr. 40,000 to industrial standardisation work has now been distributed as follows:—Kr. 15,000 to the engineering industry; Kr. 8,500 to the electrical industry; Kr. 4,000 to industrial products for agriculture, and the remainder for the general activities of the Standardisation Commission. The Commission has accepted the draft regulations for an International Standards Association elaborated at the International Conference held at New York and has approved London as the seat of the secretary-general of the new Association.—*Reuter's Trade Service* (Stockholm).

Fatality.—An inquest was held at Bradford last week into the death of Jack Whitaker, aged 12, when it was stated that the boy was found dead in a bathroom. It appears that his bare feet had come into contact with the frame of a defective electric radiator, while his hands were in contact with the bath. It was stated that in repairing the radiator, a member of the family had not properly replaced the insulation on a connecting lead, so that a bare portion made contact with the frame of the radiator.

A verdict of "Accidental death" was returned at a Blackpool inquest recently on Sarah Kate Steele, who fell from a moving tramcar and sustained a fracture of the skull, from which she died. The coroner said he was satisfied it was not safe to start a tramcar of the open-back type until all the passengers had hold of some support, and that deceased had no hold on any support when she fell.

Imperial College of Science and Technology.—The Appointments Board of the above college invites employers requiring men who have received a thorough training in the principles of engineering to make use of the services of the Board. (See our advertisement pages to-day.)

Society of Engineers (Incorporated).—By permission of the County of London Electric Supply Company, Limited, a visit has been arranged for members and their friends to the Barking power station, at 3 p.m., on Saturday, July 10th. The number is limited to 25.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

Mr. E. W. F. PORTER, assistant engineer at the Plymouth Broadcasting Station, was married at Plymouth last week to Miss G. W. ALLWORK. His colleagues presented him with a Jacobean oak clock bearing a suitable inscription.

The marriage took place at Huddersfield, on June 17th, of Mr. FRANCIS J. BOSTOCK, proprietor of the firm of Bostock and Bramley, power transmission engineers, Leeds, and Miss BEATRICE M. SYKES, of Huddersfield.

Engineer Vice-Admiral Sir ROBERT B. DIXON, K.C.B., the Engineer-in-Chief of the Fleet, has accepted the presidency of the Junior Institution of Engineers for the year 1926-1927, in succession to Mr. J. S. Highfield, M.Inst.C.E., M.I.E.E. Sir Robert Dixon's induction will take place in December next.

Mr. G. A. SAUNDERS, for many years with the British L.M. Ericsson Co., has been appointed production manager at the Dagenham works of the Sterling Company. Mr. C. C. ROE, the publicity manager of the Relay Automatic Telephone Co., Ltd., has been appointed, in addition, to fill similar duties for the Sterling Telephone & Electric Co., Ltd.

Mr. FRANCIS HODGKINSON, for many years chief engineer of the South Philadelphia works of the Westinghouse Electric and Manufacturing Company, has been appointed consulting mechanical engineer for the organisation as a whole. The position of chief engineer of the South Philadelphia Works has been abolished and instead a position of manager of engineering has been created. Mr. A. D. HUNT has been appointed to this post. Mr. Hodgkinson was born in England and was educated at the Royal Naval School, London. He went abroad in 1891, joining the Chilean Navy as an engineer officer. After holding other positions in South America, he rejoined Messrs. C. A. Parsons & Co., Ltd., and when, in 1896, the Westinghouse Machine Company acquired the American rights for the manufacture of Parsons turbines Mr. Hodgkinson, upon the recommendation of Sir Chas. Parsons, became connected with the company, which subsequently became the turbine building section of the Westinghouse Electric and Manufacturing Company. Last year Mr. Hodgkinson was awarded the Elliot Cresson Gold Medal by the Franklin Institute in recognition of his work in turbine development.

Mr. A. C. EVANS, formerly deputy manager of the electricity works at Newton Abbot, has been appointed to a position in the Birmingham Electricity Department.

Mr. T. H. HERITAGE has been appointed resident engineer and manager at the Hawick undertaking of the Urban Electric Supply Co., Ltd.

Obituary.—MR. E. A. GRAHAM.—We regret to record the death, on June 15th, at the age of 45 of Mr. Ernest Alfred Graham, principal of the firm of Alfred Graham & Co. Mr. Graham took over in 1904 the management of the business founded by his father some 40 years ago.

Mr. H. FREEMAN.—The death took place on June 21st of Mr. Harry Freeman, Wharncliffe Grove, Tankersley, Yorks., who was for some years head electrician at the Wharncliffe Silkstone Collieries.

Will.—MR. LEONARD GAUNT, J.P., of Farsley, Yorks., a director of the Kettlewell Electricity Co., Ltd., and other companies, left £188,697 gross (net personalty £172,468).

New Companies Registered.

Uneeda Supplies Co., Ltd. (214,582).—Private company. Registered June 23rd. Capital, £1,000 in £1 shares. Objects: To carry on business as electrical and motor appliance supply merchants, &c. The permanent directors are:—E. Batty, O.B.E., Copley Dene, Shepperton; J. Bolsom, 123, Westminster Bridge Road, S.E. Secretary: J. Bolsom. Solicitors: Saunders, Sobell & Co., 212, Bishopsgate, E.C.2. Registered office: 606-7, Bank Chambers, High Holborn, W.C.1.

Beko Lamp Co., Ltd. (214,465).—Private company. Registered June 19th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of, agents for and dealers in incandescent electric lamps of every description, &c. The directors are:—W. G. Bayman, M.J.I.E., F.I.S.A., Fitzalan House, Arundel Street, W.C., electrical engineer; A. F. Stokes, 184, Wimbledon Park Road, Southfields, S.W.18, electrical engineer. Remuneration (except managing director) as fixed by the company. Secretary: W. G. Bayman. Solicitors: Jenkinson, Meyler & Co., 5, Frederick's Place, E.C.

Retrosonic, Ltd. (214,576).—Private company. Registered June 23rd. Capital, £5,000 in 4,600 7½ per cent. cumulative preference and 400 ordinary shares of £1 each. Objects: To acquire any inventions relating to wireless receiving sets or wireless apparatus, to acquire from J. Wilcockson the trade mark "Retrosonic," and to carry on the business of electrical, mechanical and radio engineers, &c. The permanent directors are:—M. E. Clark (chairman), 4, Avenue Road, Doncaster; J. Wilcockson, 783, Abbeydale Road, Sheffield; H. W. Roberts, 26, Springfield Road, Sheffield. Qualification, 500 preference or 100 ordinary shares. Solicitor: H. Bedford, 30, Bank Street, Sheffield.

Sheringham Daylight Co., Ltd. (214,506).—Private company. Registered June 21st. Capital, £5,050 in 3,800 6 per cent. non-cumulative participating preference shares of £1 each and 5,000 ordinary shares of 1s. Objects: To acquire the business of artificial daylight lamp manufacturers carried on by H. Philipson as the "Sheringham Daylight Company." The directors are:—H. Philipson (chairman), Broom Hill, Esher, Surrey; G. Allan, 19, Wester Coates Avenue, Edinburgh. Remuneration of H. Philipson as chairman, £100 per annum. Solicitors: Ford, Lloyd & Co., 53, Russell Square, W.C.1.

Cable, Telephone and General Trust, Ltd. (214,601).—Public company. Registered June 24th. Capital, £202,000 in £1 shares (150,000 6 per cent. cumulative preference, 2,000 7 per cent. non-cumulative "A" preference, and 50,000 ordinary. The objects are to carry on the business of an investment and trust company, to purchase, underwrite or otherwise acquire shares, stocks and securities, &c. The minimum cash subscription is 7 shares. The subscribers (each with one ordinary share) are:—V. Summers and E. Rudland, both clerks, and five other clerks, all of 2, Bond Court, Walbrook, E.C.4. The first directors, to number not less than two nor more than nine, are to be appointed by the subscribers. Qualification, 100 shares. Remuneration at such rate (not exceeding £500 each per annum, with £100 extra for the chairman) as they may determine. Solicitors: Linklaters and Paines, 2, Bond Court, Walbrook, E.C.4.

Electro-Chemical Development Syndicate, Ltd. (214,589).—Private company. Registered June 24th. Capital, £2,500 in £1 shares. The objects are to take an assignment of an agreement dated May 1st, 1925, between the Ammonia Casale S.A., Lugano-Massagno Villa Aida, Switzerland, of the one part, and the Power Securities Corporation, Ltd., on behalf of a company then to be formed, of the other part, being an assignment of all rights and obligations under an agreement for the supervision of the interests of the Ammonia Casale S.A., and the exploitation and development of its patents and processes within certain territories; to acquire any letters patent relating to any inventions, and to carry on the business of chemists, druggists, drysalters, oil and colourmen, manufacturers of and dealers in proprietary articles, and electrical, chemical, photographic, surgical and scientific apparatus and materials, &c. The subscribers (each with one share) are:—A. Isaacs, Lennox House, Norfolk Street, W.C.2, solicitor's clerk; Ena Scott, Lennox House, Norfolk Street, W.C.2, solicitor's clerk. The first directors are to be appointed by the subscribers. The directors may borrow up to £50,000 without the sanction of a general meeting. Qualification, 100 shares. Remuneration as fixed by the company. Solicitors: Kenneth Brown, Baker, Baker, Lennox House, Norfolk Street, W.C.1.

Elmesan (London), Ltd. (214,563).—Private company. Registered June 23rd. Capital, £5,000 in £1 shares. Objects: To carry on the business of hardware and chemical merchants, electrical engineers and contractors, manufacturers of and dealers in electrical, wireless and sanitary goods, building materials and chemical products, &c. The directors are:—O. F. Ahlmann, 26, Charleville Road, W.14 (chairman and permanent governing director); Edith S. Orchard, 80, Gladsmuir Road, Highgate, N.; F. Pratt, 18, Teevan Road, Addiscombe, Croydon, engineer; H. J. Ing, 39, Sherringham Avenue, Tottenham, N. Qualification, 100 shares. Remuneration as fixed by the company. Solicitors: Jacques & Co., 8, Ely Place, E.C.1. Registered office: 66, Victoria Street, S.W.1.

Official Returns of Electrical Companies.

Hadden & Pearce, Ltd.—Debenture dated June 1st, 1926, to secure £1,300, charged on the company's property, present and future, including uncalled capital. Holder: E. Pearce, 13, Mitcham Lane, Streatham, S.W.16.

Direct Spanish Telegraph Co., Ltd. (6,732).—Capital, £95,000 in 13,000 ordinary and 6,000 preference shares of £5 each. Return dated April 27th, 1926. 12,931 ordinary and 6,000 preference shares taken up. £94,655 paid. Mortgages and charges, £100,000 4½ per cent. debentures.

Crossley Brothers, Ltd. (51,970).—Capital, £1,492,293 in 403,390 preference shares of £1 each, 1,015,414 ordinary shares of 10s. each, and 581,196 unclassified shares of £1 each. Return dated March 11th, 1926. 403,390 preference and 1,015,414 ordinary shares taken up. £405,700 paid on 278,200 preference and 255,000 ordinary. £505,397 considered as paid on 125,190 preference and 760,414 ordinary. Mortgages and charges, nil.

H. T. Boothroyd, Ltd. (99,742).—Capital, £20,000 in 15,000 ordinary and 5,000 preference shares of £1 each. Return dated December 31st, 1925. 10,002 ordinary and 2,800 preference shares taken up. £2,802 paid. £10,000 considered as paid. Mortgages and charges, £4,014.

Waste Heat and Gas Electrical Generating Stations, Ltd. (91,738).—Capital, £350,000 in £1 shares. Return dated April 9th, 1926. 320,000 shares taken up. £320,000 paid. Mortgages and charges, nil.

Wireless Warehouses, Ltd.—Satisfaction in full on June 10th, 1926, of second debenture dated March 16th, 1925, securing not more than £5,000.

Yorkshire (West Riding) Electric Tramways Co., Ltd. (84,167).—Capital, £600,000 in 350,000 preference and 250,000 ordinary shares of £1 each. Return dated March 12th, 1926. 231,305 preference and 204,885 ordinary shares taken up. £436,190 considered as paid. Mortgages and charges, £256,168.

Carlisle and District Transport Co., Ltd. (formerly City of Carlisle Electric Tramways Co., Ltd.) (62,601).—Capital, £60,000 in £1 shares. Return dated March 30th, 1926. All shares taken up. £60,000 paid. Mortgages and charges, £40,000.

Nalder Brothers & Thompson, Ltd. (62,214).—Capital, £30,000 in 15,000 preference and 15,000 ordinary shares of £1 each. Return dated December 23rd, 1925. 12,000 preference and 11,881 ordinary shares taken up. £13,881 paid. £10,000 considered as paid. Mortgages and charges, nil.

Bridgewater and District Electric Supply and Traction Co., Ltd. (75,429).—Capital, £20,000 in 15,000 ordinary and 5,000 preference shares of £1 each (increased June 10th 1926, to £30,000 in 25,000 ordinary and 5,000 preference shares of £1 each). Return dated May 29th, 1926. 15,000 ordinary and 2,657 preference shares taken up. £8,785 paid on 6,118 ordinary and 2,657 preference shares, and including £10 paid on 100 forfeited shares. £8,882 considered as paid on the remainder. Mortgages and charges, £14,400.

Hastings and District Electric Tramways Co., Ltd. (82,521).—Capital, £372,942 in 130,000 preference shares of £1 each and 485,885 ordinary shares of 10s. each. Return dated April 6th, 1926. 80,000 preference and 268,235 ordinary shares taken up. £200,000 paid on 80,000 preference and 240,000 ordinary shares. £14,117 considered as paid on 28,235 ordinary shares. Mortgages and charges, £250,000.

Rapinet, Ltd.—S. Sharpe, of Balfour House, Finsbury Pavement, E.C., was appointed receiver and manager on June 14th, under powers contained in debenture dated February 3rd, 1926.

Oxford Scientific Instrument Co., Ltd.—W. A. Pepper, of 26-30, Salisbury House, E.C.2, was appointed receiver and manager on June 14th, 1926, under powers contained in debentures dated April 28th, 1925.

Lancaster and District Tramways Co., Ltd.—T. Atkinson, of 2a, Euston Road, Morecambe, ceased to act as receiver or manager on June 16th, 1926.

Maybrook Electrical Co., Ltd.—Satisfaction to the extent of £200 on March 31st, 1926, of first debenture dated December 18th, 1924, securing £1,000.

Watford Electric and Manufacturing Co., Ltd.—Satisfaction to the extent of £1,500 on May 31st, 1926, for debenture dated May 31st, 1923, securing £3,000.

Bude Electric Supply Co., Ltd. (95,137).—Capital, £15,000 in £1 shares. Return dated May 29th, 1926. 10,000 shares taken up. £10,000 paid. Mortgages and charges, £2,500 mortgage debentures.

Bideford and District Electric Supply Co., Ltd.—Particulars filed on June 8th, of £25,000 debentures authorised April 16th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £20,000.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Edmundson's Electricity Corporation, Ltd.

The annual meeting was held on June 23rd, Mr. P. D. Tuckett (chairman) presiding. In moving the adoption of the report, the chairman said that it was eminently satisfactory, showing an additional net profit of nearly £10,000. The increase in dividends and interest reflected the satisfactory progress of the constituent undertakings during the year, and might be considered to be more or less normal, and likely, under normal conditions, to be maintained, whereas the profit on working local authority and other undertakings was exceptional, owing to a substantial improvement at Hamilton during the last year of their tenure of that undertaking. They were enabled to increase the ordinary dividend by 1 per cent. after repeating last year's appropriation of £20,000 to reserve, leaving £19,590 to be carried forward. The financial position had been still further strengthened; the investments in and advances to subsidiary and other companies showing an increase of some £94,000; whilst they had over £250,000 invested in trustee securities. They had demands for increased capital expenditure in various directions which made it not unlikely that during the next year or two a considerable portion of those securities would be replaced by a corresponding addition to their investments in electrical undertakings. During the year they had acquired on favourable terms from a company which had worked it for several years with some difficulty, the undertaking supplying Faringdon in Berkshire. They had also arranged with the Truro Corporation to undertake the supply of that town, with a bulk supply from the Cornwall Power Company. With few exceptions, their undertakings continued to make steady progress during the past year; in particular the Urban Company had been able to raise its ordinary dividend from 4 per cent. to 7 per cent., thanks to the improvement shown by the Cornwall Power Company. Excluding the Lancashire Power Company, their connections increased by over 6,000 kW, whilst they sold 3¼ million additional kWh. They were bound to suffer in common with other producers from the coal dispute, and he could not now say how far their normal progress might be arrested. Fortunately, they had ample stocks of coal when the dispute started, and they still had sufficient to meet their needs for some considerable time, so that their anxiety was not so much a question of coal, as a question of load. Referring, in conclusion, to the Electricity (Supply) Bill, he said that he was sorry to say that, in common with most of the responsible representatives of the various sections of the electricity supply industry, they viewed the Bill with the utmost misgiving, believing that it was far more likely to hamper than promote the progress of the industry. The Government proposed to stimulate the use of electricity by cheapening its cost and facilitating its distribution, by the strange expedient of creating a new set of officials to add to the confusion, interference and expense from which the industry was already suffering. When, some two years ago, the Labour Government outlined a somewhat similar policy, tending to the nationalisation of the industry, it was at least consistent in recognising that Government interference could only be effective if backed by a subsidy at the taxpayer's expense; whereas the present Government, whilst properly refusing to resort to a subsidy, nevertheless appeared to entertain the belief that a new Central Electricity Board would be able to produce economies and other beneficial results which those now responsible for the conduct of the industry, despite their intimate familiarity with its needs and limitations, were incapable of producing. He did not doubt that the Prime Minister was inspired by an honest belief that the policy was justified, since it was largely founded on the recommendations of the Weir Report, and on the expert technical advice which the Government had received, but, whereas presumably he accepted those recommendations and that advice without question as incontrovertible, the industry generally refused to so regard them, and was convinced that if they were subjected to independent examination, they would be shown to be largely fallacious. The primary fallacy underlying the Weir report and the Government's whole case, was the assumption that the smaller consumption of energy per head of the population in this country as compared with the United States and other countries, was due to some want of energy or initiative on the part of existing undertakers, rather than to the inherent differences in the conditions, and the overwhelming handicap which past legislative restrictions had imposed on the industry here. Until the Government intervened, the industry, despite its handicaps, was making rapid strides towards the attainment of the objects which the Government had in view, and if left free to continue on sound lines, dictated by experience and the progress of technical development, would, in his judgment, have succeeded in reaching the goal of a cheap and abundant supply more rapidly and surely than was likely to be the case under the complicated and hampering provisions embodied in the Bill. So far as their small isolated undertakings were concerned, they would welcome the prospect of cheap bulk supplies, provided that, in the event of purchase by the local authority, they were not prejudiced by the shutting down of the stations. They thought, however, that it would be many years before most of them were brought within range of the cheap bulk supplies contemplated by the Government, owing to the excessive cost of transmission and conversion. They would continue to watch the Bill and to press their objections, in the hope of modifying some of its worst features, but they were no longer hopeful of being able to convert it into a really useful measure. The report was adopted.

United Electric Tramways of Montevideo, Ltd.

The annual meeting was held on June 25th. Mr. G. Balfour, M.P., presided in the absence of Sir George Touche, Bart. (chairman), and read a speech prepared by the latter. This stated that expansion had continued during the past year in spite of certain adverse factors which interfered with the normal development of traffic. Pending the judgment of the tribunal in the suit brought by the company and its associates against the Municipality for wrongful intervention to impose higher rates of wages, those rates were being maintained. The directors would be glad to improve the living conditions of the employés if it were economically possible. The number of passengers carried rose by 1,469,201 to 81,544,137—about 215 times the population of the city. The Senate had not yet dealt with the company's petition to be allowed to increase its fares. The heavy burdens placed on the company by various social laws as well as increased costs had been borne by the company for many years, with detriment to the holders of the company's securities and prejudice to Uruguayan investments. No increase granted now could recompense the company for past losses but even a belated revision would be of assistance in helping the company to deal with current requirements, including the increasing of facilities for public travel. They still looked forward to a fair and equitable settlement to the benefit of both the community and the company. One of the latest charges placed upon the company was a share of the cost of re-paving work estimated to cost £330,750 spread over a period of years. Whereas before the war the company paid a steady dividend of 7 per cent. on the ordinary shares, only three dividends had been paid in the last eleven years.

Globe Telegraph and Trust Co., Ltd.

The annual meeting was held on June 22nd, Sir John Denison-Pender, G.B.E., presiding. In presenting the report (ELEC. REV., June 25th, p. 969), the chairman said that although the gross receipts had declined slightly the net income showed an increase. The amount received from the American Telegraph & Cable Co. had been declared subject to American income tax, and last year's contribution had been reduced by the payment of arrears. The reduction of the Great Northern Co.'s dividend also affected the company slightly. Other small reductions occurred in the amounts received from the Commercial Union and the Mackay Companies owing to the appreciation of the pound sterling, and as the Submarine Cables Trust certificates were redeemed receipts from that source declined. The coupons of reversion attached to the Trust's bonds would give the company a sum of over £100,000 when the imminent winding-up of the Trust

was accomplished. The receipts from National War Bonds were lower owing to the sale of a part of the company's holding. On the other hand the receipts from the Indo-European and Western Union Companies had increased and the company had also received the full dividend from its holding of Commercial Cable debenture stock purchased last year. The company had invested in the American Telephone & Telegraph Co. in time to participate in a new issue of one new share at par for every six held. After referring to the activities of associated companies, the chairman said that the value of the company's holdings at May 31st showed an appreciation of £2,417,820 over cost. The report and accounts were adopted.

Anglo-Argentine Tramways Co., Ltd.

The report for the year ended December 31st last states that the gross receipts amounted to £4,657,079, and the net income to £1,068,676. After adding interest, &c., and deducting debenture interest, sinking fund allocations, &c., there remains a balance of £435,604, which, together with £24,046 brought forward, makes available £459,650. The dividends are paid on the first and second preference shares, £50,000 is transferred to the contingencies fund, £10,000 is written off investments, and £40,650 is carried forward. The number of passengers carried rose from 557,849,937 to 559,537,275, and the ratio of working expenses to receipts from 70.50 to 72.53 per cent. Renewals cost £201,839 during the year, and in anticipation of future heavy maintenance charges the allocation to the renewals reserve has been increased to £250,000. No settlement has been reached with the municipality regarding the question of the tariff. The Argentine courts have held that it is impossible for the company to make the pension provisions required by law unless it is allowed to raise its fares. In the meantime traffic conditions in Buenos Aires are becoming worse, for the company cannot proceed with its costly plans until the tariff question is settled. The directors deplore the delay but hope that a settlement will be reached soon. Mr. Gunning has retired from the board and Mr. W. D. Dawes has been appointed to it as managing director. The meeting was to be held yesterday (Thursday).

Sevenoaks and District Electricity Co., Ltd.

In moving the adoption of the report and accounts (*vide* our last issue, p. 969) at the annual meeting on June 23rd, the chairman (Mr. C. F. Tufnell) said that during the year under review considerable extensions were made and several new districts were opened up. There was still, however, a very large area to be developed and a further scheme was to be put in hand during the current year. They were finding it necessary to increase their plant and had been advised to approach the power company nearest to their area. The price quoted was higher than that at which they could generate electricity themselves and they had accordingly secured the Electricity Commissioners' permission to add to their plant. Their experience was not unique and he (the chairman) thought that many small undertakings would find it better to continue generating rather than take bulk supplies over long distances. The directors were watching the progress of the Electricity (Supply) Bill with a good deal of anxiety and hoped that amendments would be made to render it more acceptable to the industry.

Barcelona Traction, Light and Power Co., Ltd.

The annual meeting was held in Toronto on June 22nd, Mr. Miller Lash (vice-president) presiding. The chairman, in presenting the report (ELEC. REV., June 18th, p. 924) said that the freedom of Spain from labour troubles under the military directory was reflected in the satisfactory increase (10.71 per cent.) in the net earnings. With regard to the current year, although the slackness in industry and the Daylight Savings Act had had an adverse effect, the earnings for the first five months showed an increase of 4.33 per cent. over those for the corresponding period of 1925. The change from a military directory and the end of the Moroccan war should prove beneficial to the company; they had already caused an improvement in the exchange which, it was hoped, would be maintained. The policy of improving and adding to existing hydro-electric stations rather than constructing new ones had been followed throughout the year with satisfactory results. The prior lien "A" bonds of the company had been redeemed on June 1st, making the consolidated 6½ per cent. prior lien bonds the first security of the company.

Liverpool Overhead Railway Co.

An extraordinary general meeting of the company was held on June 22nd, to consider the position of the undertaking and its future prospects. Alderman M. H. Maxwell, chairman of the company, who presided, said the meeting was held in fulfilment of a promise made at the annual meeting of shareholders in March. Mr. A. T. Harding, chairman of the Committee appointed by the shareholders at the annual meeting, said that the Committee's report stated that the generating plant was over thirty years old, and very costly to run. The cost of generation was 1.015d. per kWh; the Liverpool Corporation was prepared to supply in bulk at 0.7467d. per kWh. The Committee considered that it was most desirable that arrangements should be made as soon as possible to scrap the present obsolete plant and obtain the necessary power either from the Corporation, the L.M.S. Railway, or some other source. As no dividend had been paid on the ordinary shares for some years, the Committee considered that the directors should forgo at least part of their fees, but the directors would not agree to that. One cause of reduced revenue was stated to be irregularities in connection with the issue and disposal of tickets in books. The Committee had been informed that owing to ill-health the general manager had been absent from business for considerable periods, which they considered unfortunate in view of the critical position of the company. The report next criticised the salaries of the general manager and the assistant manager, which were considered too high for so small a company. Unless drastic economies were at once effected, and efficient supervision exercised, the prospects of the shareholders were very black, as the company would probably pass into the hands of a receiver for the debenture holders within the next few years. A resolution was moved and seconded that the report of the Committee be accepted and printed, but the chairman refused to accept any resolution, saying that he was legally advised that any resolutions would be out of order.

Ruston and Hornsby, Ltd.

In the course of his speech at the annual meeting on June 21st, Col. J. S. Ruston (chairman) said that the position of the company was satisfactory and the results of the past year's working were gratifying, having regard to the conditions existing in the engineering industry. The company had been assisted by the Exports Credits scheme, but it was felt that in the future the company must rely upon the usual methods of business upon which its trade had developed. During the year they had begun to benefit from the drastic and costly revision of production, which had been necessary to enable them to maintain their position in the world market. Since the war their chief production had been large internal combustion engines suitable for central power stations, large excavating machinery, &c.

French Companies.

The *Compagnie de Locations Electriques* records net profits of 743,000 fr. for 1925 and a dividend of 5 per cent. on the ordinary and preference shares.

The *Compagnie des Câbles Télégraphiques* reports a gross surplus for 1925 of 5,338,000 fr. as compared with 6,036,000 fr. in the previous year. The sum available for distribution is 4,038,000 fr.

The *Compagnie Electro-Mécanique*, whose net profits of 320,000 fr. for 1925 have been carried forward, states that the results were affected by the inadequate prices charged in the electrical industry owing to keen competition, while the past year also had to bear the burden of old long-term contracts entered into on conditions which were not very satisfactory and became more onerous through the fall in the franc. The erection of the first turbo-generator set, 35,000 kW, at the Nord station of the Compagnie Parisienne de Distribution was completed last November; two other sets of 35,000 and 50,000 kW respectively will be placed in service before the end of 1926; and a third order for a set of 35,000 kW has just been received. As the railway companies had been compelled to reduce their expenditure no further orders had been booked for electrical rolling stock, but the delivery of the 80 locomotives for the Orleans Railway Company was being continued as well as of the engines ordered by the State Railways and for industrial purposes.

German Companies.

Brown, Boveri and Company, Mannheim, report that the turnover in 1925 exceeded that in the previous year by 50 per cent. and a good volume of orders is on hand at the present time. It is proposed to pay a dividend of 7 per cent. on the ordinary shares and one of 6 per cent. on the preference capital.

The *C. Lorenz Company*, Berlin, reports that 1925 did not come up to full expectations as, despite an increase in the orders and the turnover as compared with the previous year, the sale prices had a falling tendency, while the costs of production advanced. The net profits declined from 788,000 marks in 1924 to 552,000 marks last year and the dividend is reduced from 10 per cent. to 8 per cent.

Swedish-Mexican Company.—During the past financial year *Mexikanska Telefonaktiebolaget Ericsson* realised a net profit of kr. 870,000, as compared with kr. 810,000 for the previous year. The directors propose an unchanged dividend of 12 per cent.—*Reuter's Trade Service* (Stockholm).

Low Temperature Carbonisation, Ltd.—At an extraordinary meeting last week resolutions were confirmed sanctioning the reduction of the company's capital from £1,275,000 to £162,150 10s. by the cancelling of 2s. 6d. per share of the 10s. "A" preference shares, 17s. 6d. of the £1 participating preference shares, and 18s. of the £1 ordinary shares; the sub-division of each class of share into 6d. shares; the consolidation of these shares into ordinary shares of 2s. each; the subsequent increasing of the capital to £1,275,000 by the creation of 11,128,495 new ordinary shares of 2s. each, to enable a scheme of arrangement with Gas & Fuel Plants, Ltd., and the Barnsley Smokeless Fuel Co., Ltd., to be carried into effect; and approving the scheme of arrangement.

Crompton & Co., Ltd. — The report for the year ended March 31st last states that the net profit, after providing for depreciation, debenture interest, &c., is £16,446, and to it is added £11,927 brought forward, making £28,373. The interim preference dividend absorbed £4,925; it is now proposed to pay the final preference dividend and to carry forward the balance of £18,522. The last distribution on the ordinary shares was 5 per cent. in respect of 1921-22. Mr. S. W. A.

Noble has retired from the board and Brig.-Gen. C. H. Whittington, C.M.G., has been appointed a director. The meeting was to be held yesterday (Thursday).

Chloride Electrical Storage Co., Ltd.—The report for the year ended March 31st last records a profit of £157,395, after providing for taxation and depreciation. The deduction of interim dividends leaves £139,054, to which is added £40,581 brought forward, making £179,635. The final preference dividend is paid and the directors propose to distribute a final dividend of 5 per cent. and a bonus of 2s. per share, both free of tax, on the ordinary shares. The employés' pension fund receives £8,000, the employés' benefit fund £2,000, and the reserve £75,000 (making £175,000), leaving £43,331 to be carried forward.

New General Traction Co., Ltd.—The revenue for the year ended March 31st last was £12,805 and the profit £10,425, as compared with £9,887 in 1924-25. The addition of £3,695 brought forward makes available £14,120. It is proposed to transfer £3,000 to reserve, to again pay a dividend of 4½ per cent., and to carry forward £1,689. The Norwich Electric Tramways Co. paid a dividend of 4 per cent. but the Douglas Southern Electric Tramways decided not to make any distribution in view of the expiration of its concession. Meeting, to-day (Friday).

Prospectus.—*Telephone Manufacturing Co., Ltd.*—The list was opened on June 25th and was to close on or before Wednesday last in connection with an issue of 1,590,000 10s. shares by this company at the price of 7s. 6d. each. This was the outcome of the scheme for the reorganisation of the company's capital recently approved by the Court. The objects of the issue are to pay off indebtedness to the company's bankers and to redeem the outstanding 8 per cent. cumulative income bonds, as well as to provide additional working capital.

Altrincham Electric Supply, Ltd.—A profit of £29,180 is recorded for the past year, and after providing for the preference dividend there remains £25,708. It is proposed to put £641 to the reserve for bad and doubtful debts, and £18,639 to general reserve, and to pay a dividend of 7½ per cent. on the ordinary shares and one amounting to £1,750 on the deferred shares, leaving £1,750 to be carried forward, subject to directors' fees.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—The accounts for the year ended December 31st, 1925, show a profit of £22,138, as compared with £18,504 in the preceding year. After providing for depreciation and debenture interest and adding the balance brought forward, there remains £2,752. It is proposed to pay a dividend of 5 per cent. on the ordinary shares and to carry forward a balance of £252. The meeting was to be held yesterday (Thursday).

Stanton Ironworks Co., Ltd.—The report for 1925-26 states that the demand for the company's products continues to increase and its foundries have been fully occupied although prices have been low. It is proposed to pay a final dividend of 6 per cent., free of tax, on the ordinary shares, making 10 per cent. for the year, to put £50,000 to reserve for depreciation, and to carry forward £148,700.

Eastern Telegraph Co., Ltd.—The directors announce the payment of a dividend at the rate of 3½ per cent. per annum on the preference stock for the quarter ended June 30th, and a first quarterly interim dividend of 2½ per cent. on the ordinary stock, free of tax.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The directors have declared an interim dividend for the three months ended March 31st last of 5s. per share, free of tax.

Reduction of Capital.—DURAM, LTD., AND REDUCED.—A petition for the confirmation of the reduction of capital of this company from £137,000 to £102,000, has been presented to the High Court and will be heard in London on July 6th.

British Columbia Electric Railway Co., Ltd.—A dividend at the rate of 5 per cent. has been declared on the cumulative perpetual preference stock in respect of the half-year ended June 30th.

General Electric Co., Ltd.—The directors propose to pay a dividend of 7½ per cent. (as last year) upon the ordinary shares out of profits amounting to £1,076,809 for 1925, as compared with £1,029,983 in the preceding year.

St. James' and Pall Mall Electric Light Co., Ltd.—The directors have declared an interim dividend of 3s. 6d. per share on the preference shares and one of 5s. per share on the ordinary shares, as in 1925.

Stocks and Shares.

MONDAY EVENING.

THE end of the first half of the year brings, as a rule, hints of money becoming tighter, and draws into focus the possibility of investment stocks yielding ground as a result. This year, the amount of surplus capital which is available for employment in stocks and shares has been greatly swollen as a direct effect of the coal stoppage, and in this present week there is presented the unusual feature of reasonable hopes that the Bank Rate will be reduced in the near future. The current 5 per cent. has been in force since the beginning of December last, and it is expected that the Bank will be able to lower its rate to 4 per cent. Should this be done, a decided impetus would be given to business in stocks and shares, and, in anticipation, a good many prices are better on the week.

The violent fluctuations in the Underground Electric Railways of London securities have subsided. Prices have recovered to some extent, and the next developments are awaited with keen interest. A good many stocks and shares in the electricity sections were quoted ex dividend last Thursday, and, as testimony to the strength of markets as a whole, it may be mentioned that the majority of the deductions were recovered, either wholly or in part, within the course of a day or two.

More favourable accounts are being received from Mexico, where the Government is declared to have in contemplation an early resumption of payments on the national bonds. Prediction fixed Thursday in this week, July 1st, as the date upon which Mexican Government bonds, long in arrears of interest, would once more receive payment of coupons, but nothing official has transpired, and it looks as if optimism had run too fast. Nevertheless, the prices of utility stocks and shares are mounting and gains of several points are recorded. Upon a better basis, substantial improvements have occurred in Anglo-Argentine Tramways first and second preference. The company has issued a report which shows a steady advance in prosperity, and, although some disappointment is felt at the absence of agreement between the company and the Buenos Ayres municipality, hopes are entertained that a permanent settlement of the matters in dispute is being brought steadily nearer. The company's two classes of preference shares and the 5 per cent. debenture stock have all responded to the good report.

British Electric Traction ordinary and preference are both marked ex dividend, and have recovered some of the dividends, 5 per cent. on the ordinary and 3 per cent. on the preference, taken off the prices last Thursday. Brazilian Tractions are 101. British Columbia deferred and the 4½ per cent. debenture are 1 up. London United Tramways 4 per cent. debenture is marked ex dividend at 48.

General Electric shares have gone back to 29s. 3d., showing a fall of 1s.; upon disappointment with the maintenance of the previously-paid 7½ per cent. dividend, whereas an advance had been expected. The company's profit for 1926 at £1,077,000 is about £47,000 up, and the figures are regarded in the market as being satisfactory. This is the second year in succession in which 7½ per cent. has been paid, the three previous years each producing 5 per cent. In 1921, the company paid 10 per cent. tax free. The amount of issued ordinary share capital has been the same throughout this period of six years, namely, £2,111,975.

Crompton ordinary shares from 15s. have fallen to 13s. 3d., hopes not having been realised that there might be a dividend on these for last year. Nothing has been paid on the ordinary for the last three years. The profit of £26,300 goes against £30,300 in the previous accounts. The company is paying its preference dividend, making 7 per cent. Cromptons is a baby of the Armstrong-Whitworth Development Company.

Electricity supply shares are uninteresting. Notting Hill preference have hardened and Edmundsons are better upon the recent report and the increase of 1 per cent., to 8 per cent., in the dividend on the ordinary shares. City Lights are rather lower. There has been an eruption of Southern Counties Electric Light & Power Supply, Ltd., prospectuses. The debentures and shares are not sound investments.

The strength of cable stocks and shares is a noteworthy feature amongst the industrial markets. The Eastern quartette stands out with particular strength. Western Telegraphs, which we were indicating last week (p. 970) as still the cheapest of the group, gained 7s. 6d., the price rising to 18, but Globe ordinary, at 18¾ ex dividend, have gone up 10s., the preference at 11 x.d. recovering the 3s. deduction. The dividend on the ordinary shares is paid, of course, free of tax, while that on the preference is gross. At the meeting a few days back, the chairman, Sir John Denison-Pender, mentioned that a new investment had been made by the company in the American Telephone & Telegraph Company, which owns, or has a controlling interest in, all the telephone companies of the United States. Anglo-American preferred and deferred are both better. Automatic Telephones remain at 50s.

The wireless group is quiet, Marconis at 1¼ being easier on the week. The deplorable report of the Burndept Wireless Company has lowered the price to a nominal quotation of 6s. 3d. middle. Earlier this year it stood at a little over 20s.

In the railway market, Underground ordinary and the "A" shares are both better, recovering from the weakness that overtook them upon publication of the reorganisation details that are to be laid before the shareholders of the company on July 29th. Metropolitans and Districts are easier.

Manufacturing shares are again very firm, rises having occurred in British Insulated, Brush, Johnson & Phillips, Siemens and British Aluminium ordinary. Telephone Manufacturing shares, which were run up to 8s. 3d. the other day, have come back to 7s. 6d. upon what is expected to prove an under-subscription by the public of the offer of the company's shares at 7s. 6d. each. Details had not been made public up to this (Monday) evening, but are expected to be in the hands of allottees and underwriters in the course of a day or so. British Thomson-Houston preference at 22s. 9d. are a few pence down.

The rubber share market is firm without attracting any noticeably active business. Expectation looks for an improvement to take place in the statistical position during the coming autumn.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1924	Dividend. 1925.	Price June 28 1926.	Rise or fall.	Yield. p.c.
Bournemouth and Poole	1	14	14	27/6	—	4 17 5
Brompton Ordinary	1	10	10	31/9	—	*6 6 1
Charing Cross Ordinary	1	15	15	45/9	—	6 10 10
do. do. 4½ Pref.	1	4½	4½	17/-	—	5 5 11
Chelsea	1	12	12	2	—	6 0 0
City of London	1	15	15	48/3	−1/16	6 4 4
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	27/-	—	5 18 6
County of London	1	15	15	58/8	—	5 3 3
do. do. 6 % Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	8	24/ xd	+9d.	6 13 4
do. 7% Pref.	1	6	7	23/-	+6d.	6 1 9
Elec. Supply Corporation	1	10	10	31/3	—	6 8 0
Kensington Ordinary	5	15	15	13½	—	5 9 1
Lancs. Light and Power	1	7½	7½	21/6	—	6 2 5
London Electric	1	10	10	32/6	—	6 3 1
do. do. 6% Pref.	5	6	6	5 7/8	—	5 10 8
Metropolitan	1	11	11	37/-	—	5 18 11
do. 4½% Pref.	1	4½	4½	17/- xd	—	5 5 11
Midland Counties	1	5½	6	21/-	—	5 13 1
Newcastle-on-Tyne Ordinary	1	7	7	22/-	—	6 7 3
do. 5% Pref.	1	5	5	18/-	—	5 11 1
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10xd	+½	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	17½	16½	—	5 8 6
South London	1	15	15	2½	—	6 0 0
South Metropolitan Pref.	1	7	7	26/3	—	5 6 9
Urban Ordinary	1	4	7	1 1/8	—	6 11 9
do. 6% Pref.	1	6	6	1	—	6 0 0
Westminster Ordinary	1	15	15	44 6		6 16 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	2 /3	—	7 8 0
Yorkshire Elec.	1	8	8	27/-	—	5 18 6

HOME RAILS.

Central London Ord. Assented	Stock	4	4	69	—	5 15 11
Metropolitan	,,	5	5	64½	−½	7 15 0
do. District	,,	3½	3½	43½	−½	6 10 10
Underground Electric Ordinary	10	Nil	Nil	2⅝	+⅛	Nil
do. do. "A"	1/-	Nil	Nil	11 6	+ 1/-	Nil
do. do. Income	Bonds	6	6	101	—	*5 18 10

TELEGRAPHS AND TELEPHONES.

		Dividend. 1924	Dividend. 1925.			
Anglo-Am. Tel. Pref.	Stock	6	6	105	+½	5 14 3
do. Def.	,,	1½	1½	24½	+¼	6 2 5
Automatic Telephone	1	8	8	2½	—	4 0 0
Chili Telephone	5	6	5	6¾	—	*3 12 9
Cuba Sub. Ord.	10	5	5	7⅜xd	—	7 8 2
Eastern Extension	10	10	10	18¼	—	*5 9 7
Eastern Tel. Ord.	Stock	10	10	182½	—	*5 9 7
Globe Tel. and T. Ord.	10	10	10	19¾xd	+¼	*5 6 8
do. do. Pref.	10	6	6	11xd	+3/-	5 9 1
Great Northern Tel.	10	22	20	27½	—	7 5 6
Indo-European	25	8½	10	45½	—	*5 10 0
Marconi	1	10	10	1¼	−1/16	7 17 10
Marconi Marine	1	10	7½	21/3	—	7 1 2
Oriental Telephone Ord.	1	12	12	45/-	—	*5 6 8
United R. Plate Tel.	5	8	8	8	—	*5 0 0
Western Telegraph	10	10	10	18	+⅛	*5 11 1

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	5 1/16xd	+1/16	8 6 0
do. do. 2nd Pref.	5	6	6	9¼xd	+¼	10 8 8
do. do. 5% Deb.	Stock	5	5	73½	+2	6 16 1
British Electric Traction Ord.	,,	7	8	14(xd	+2	5 14 4
do. do. 6% Pref.	,,	6	6	110xd	+1	5 9 1
Brazil Traction	100	4	5	101	+1	4 19 0
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	88½	—	5 17 0
do. do. Preferred	,,	96/-	126/9	105½	—	*6 0 2
do. do. Deferred	,,	129/5	8	128	+1	*6 5 0
do. do. Deb.	,,	4½	4½	78	+1	5 9 0
London & Sub. Trac. 5% Pref.	1	2½	Nil	6/-	—	Nil
London United Tram. Deb.	Stock	4	4	47xd	—	8 10 2
Mexico Trams 5% Bonds	—	5	5	73½	—	7 4 0
Mexican Light Common	100	Nil	Nil	33½	—	Nil
do. Pref.	100	Nil	Nil	78½	+2	Nil
do. 1st Bonds	—	5	5	72½	+1	6 17 11
Yorkshire (West Riding)	1	5	—	11/-	−3/-	... ...

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	12	18	51/-	—	*5 2 0
British Aluminium Ord.	1	5	10	47/6	+1/6	4 4 3
British Elec. Transformer Pref.	1	Nil	7	18/9	—	7 9 4
British Insulated Ord.	1	15	15	2½	+⅛	4 5 9
Brush Ord.	1	10	10	28/-	+1/-	7 2 10
Callenders	1	15	15	3⅜xall	—	4 8 11
do. 6½% Pref.	1	6½	6½	2 /-xd	+6d.	5 9 5
Crompton Ord.	1	Nil	Nil	13/8	−1/9	... ...
Edison-Swan	4/-	10	10	9/9	—	4 2 0
do. 5% Deb.	Stock	5	5	82/ xd	—	6 1 11
Electric Construction	1	10	10	32/-xd	+1/-	6 5 0
Enfield Cable, Pref.	1	7½	7½	1 7/8xd	—	6 6 4
English Electric	1	5	Nil	16/8	—	... ...
do. do. Pref.	1	6	6	19/-	—	6 6 4
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
,, Ord.	1	5	7½	29/3	−1/-	5 1 7
Henley	1	16	20	3½xd	—	5 3 3
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	23/-	—	*4 6 11
Johnson & Phillips	1	10	17½	3½	+⅛	5 7 8
Met.-Vickers Ord.	1	8	8	21½	+⅛	6 8 0
do. Pref.	2	8	8	2½	—	6 8 6
Siemens Ord.	1	7½	7½	28/9	—	5 4 4
Telegraph Construction	12	20	10	28½	—	*4 5 0

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances

CHEMICALS, &c.		Price June 29th.	Fortnight's inc. or dec.
a Acid, Oxalic	per lb.	5¾d.	...
a Ammoniac, Sal	per ton.	£60	...
a Ammonia, Muriate (large crystal)	,,	£52	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£25	...
a Copper Sulphate	,,	£25 10s.	...
a Potash, Chlorate	per lb.	4d. to 4½d.	...
a ,, Perchlorate	,,	5½d.	...
a Shellac	per cwt.	£15 15s.	...
a Sulphur, Commercial	,,	£9 10s.	...
a ,, Roll	,,	£9 10s.	...
a Soda, Chlorate	per lb.	3½d. to 3¾d.	...
a ,, Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks	per lb.	4d.	...
METALS, &c.			
b Aluminium, Ingots	per ton.	£120 to £125	...
b ,, Wire	per lb.	1/9 to 2/6*	...
b ,, Sheet	,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net.	£246	£4 inc.
Grade II	,, ,,	£172	£3 inc.
Grade III	,, ,,	£94	£ inc.
c Brass (rolled metal 2" to 12" basis)	per lb.	9¾d.	...
c ,, Tubes (solid drawn)	,,	11½d. to 1/-	...
c ,, Wire, basis	,,	9½d.	
c Copper Tubes (solid drawn)	,,	1/0½	...
c ,, Bars (best selected)	per ton.	£90	...
c ,, Sheet	£90	...	
c ,, Rod	£90	...	
d ,, (Electrolytic) Bars	£6 10s.	...	
d ,, ,, Sheets	£144 10s.	...	
d ,, ,, Wire Rods	£75 10s.	...	
d ,, ,, H.C. Wire	per lb.	9½d.	...
f Ebonite Rod	2/3 to 2/6	...	
f ,, Sheet	2/3 to 2/6	...	
n German Silver Wire	2/2	...	
h Gutta-percha, fine	8/-	...	
h India-rubber, Para fine	1/8	1½ inc.	
i Iron Pig (Cleveland No. 3.)	per ton.	72/6	...
,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g Lead, English pig	£31 10s.	10/- dec.	
g Mercury	per bot.	£15 7s. 6d. to £15 10s.	...
e Mica (in original cases) small	per lb.	3d. to 3/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large	,,	10/ to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/3½	...
p ,, ,, drawn bars & rods	,,	1/3	...
p ,, ,, rolled strip & sheet	,,	1/2½	...
p ,, ,, wire	,,	1/3½	...
o Platinum	per oz.	£23 10s.	...
d Silicium Bronze Wire	per lb.	11½d.	...
r Steel, Magnet, in bars	,,	7½d.	...
n Tin, Block (English)	per ton.	£270 to £272	£14 5s. to £14 15s. inc.
n ,, Wire, Nos. 1 to 16	per lb.	4/1	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd,
r W. F. Dennis & Co.

Electrostatic Machines.—In a paper which he recently read before the Physical Society of London, Mr. Evan J. Evans, M.Sc.(Lond.) of the Sir John Cass Technical Institute, described experiments with a large electrostatic machine used as a source of potential for the discharge through (*a*) a Coolidge X-ray tube, and (*b*) a non-inductive resistance. The results were represented in the form of characteristic curves; in the former case it was shown that above a certain critical voltage the discharge was intermittent, while in the latter case the discharge was continuous for all voltages. The cause of the intermittence of the current through the Coolidge tube was assigned to the operation of the Pearson-Anson effect, which implied that the effect of the residual gas in such tubes was not completely insensible above a certain voltage.

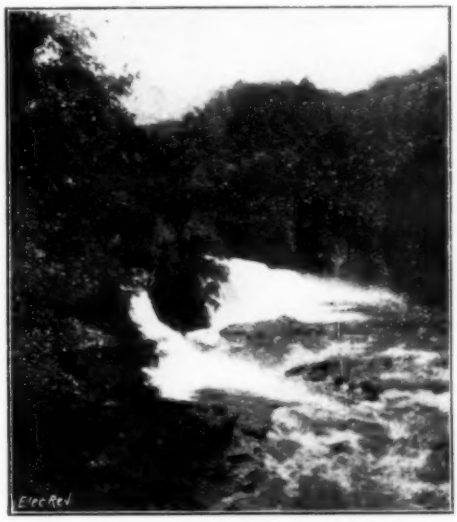
Major C. E. S. Phillips said that all who were interested in medical X-ray work would welcome this investigation, because practitioners now aimed at constant conditions of voltage, and the subject was therefore of considerable practical importance. A modern outfit for supplying the high voltages employed was expensive and bulky; a less elaborate source, giving an e.m.f. in the neighbourhood of 300,000 volts, was greatly needed, and perhaps the paper would lead some inventor to produce a satisfactory modification of existing electrostatic machines. It seemed very surprising that a Coolidge tube, whose resistance was constant to 1 per cent. with a transformer, should give rise to intermittent current with a machine. Had the author experimented with different types of tube, such as a large-volume deep-therapy tube and a radiator tube? It might even be worth while to study the effect of admitting a little gas. The author said that both the tubes used by him were of the radiator type; the filament current during the experiments was about 75 per cent. of that for which the tubes were rated.

The Incorporated Municipal Electrical Association.

Annual Convention at Glasgow.

(*Concluded from page 972.*)

THE special meeting for women mentioned in our last issue was presided over by Mrs. Mackellar Dewar, who opened the meeting with a brief explanation of the objects of the Electrical Association for Women, and introduced the lecturer. Dr. Christina Barrowman is a graduate of Glasgow University, and has a large practice in Newcastle-on-Tyne, where she specialises in electrical methods of treatment, with excellent results. With the aid of apparatus supplied by Messrs. D. B. Selkirk & Co. and Messrs. Kelvin, Bottomley & Baird, of Glasgow, Dr. Barrowman demonstrated the use of a variety of the latest appliances, with special reference to those which can be safely used in the home, concluding with experimental illustrations of the properties of ultra-violet light. Lady Belhaven and Stenton, president of the Glasgow Branch of the E.A.W., proposed, and Miss Haslett seconded, a hearty vote of thanks to the lecturer.



A View of the Falls.

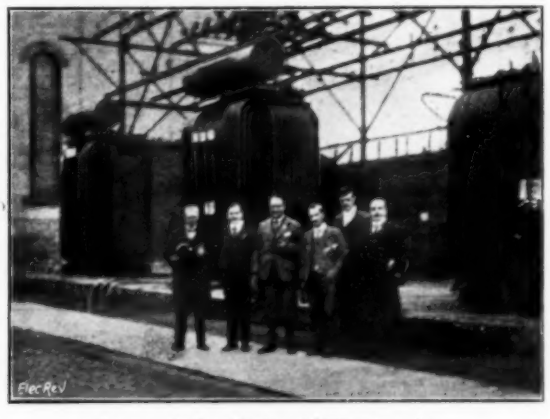
In the evening the annual dinner of the Association was held, Mr. R. B. Mitchell presiding, and there was a very large attendance; a report of the speeches is given on a later page. A very good musical entertainment was provided, and dancing followed.

On Friday morning, June 18th, the annual general meeting, and a special general meeting to consider the revision of the Articles of Association, were held, in private. Mr. R. W. L. Phillips (Bedford) was elected president, and Mr. F. W. Purse (West Ham) vice-president. In the afternoon the party divided, the majority driving to Trossachs, whilst the remainder visited the Clyde Valley hydro-electric works at the Falls of Clyde, which were described in our last issue. Brilliant sunshine contributed to the enjoyment of these delightful excursions, which formed an admirable finale to the official programme of the Convention.

The Visitors at Bonnington.

At the Falls the visitors were received by Mr. E. T. Goslin, chief engineer, Mr. D. Macfarlane McLeod, the engineer in charge of the work, and other representatives of the company, who led them through the fields to the surge tower of the Bonnington installation; there a photograph of the group was taken, after which the members walked down by the pipe line to the power house, in the turbine room of which delicious refreshments were awaiting them, provided by the company. Afterwards there came a delightful walk through the woods along the bank of the river, far above the milk-white rapids, with charming views at intervals of the Bonnington and Corra Linn falls, to the head works, where the intake screens and the tilting weir were inspected with interest. The return journey to town, *via* Lanark, afforded glimpses of the Clyde and of the Stonebyres power-house buildings, further down the river. Altogether it was a most enjoyable and instructive afternoon, and the President, who referred to the cordial relations that exist between the Clyde Valley Company and the Glasgow Corporation, in the course of a brief speech at the Bonnington works, accurately expressed the thoughts of the visitors when he heartily thanked the Company for its hospitable reception.

Various works and factories in the neighbourhood of Glasgow were open for inspection during the week, and on Saturday morning a party visited the Kilmarnock electricity works of the Ayrshire Electricity Board. Some particulars of the undertaking of the Corporation of Kilmarnock were given in the ELECTRICAL REVIEW of December 1st, 1922; since then further developments have taken place, including the formation of the Ayrshire Electricity Board, whose operations cover the whole of the county, an area of 1,400 square miles; the generating plant at Ayr has been shut down, and the whole of the supply is taken from Kilmarnock power station, which now, with the addition of a second B.T.-H. 12,500-kW turbo-alternator, has plant of about 35,000-kW capacity. The pressure is stepped up from



Some of the Party at Kilmarnock.

3,300 V to 11,000 V for the earlier transmission lines, and to 22,000 V for the later ones, which extend from Kilmarnock to Paisley and thence to Greenock, the three towns thus interconnected operating their plant so as to secure the maximum economy. The greatest distance of transmission is about 45 miles, from Kilmarnock to Greenock, by two three-phase lines each of 10,000-kW capacity. Outdoor transformer stations are used, and many farms are supplied from the 11,000-V lines by pole transformers. The diversity of industries taking power from the Board is a valuable feature of the undertaking, and mitigates the effect of the present depression in the shipbuilding and engineering industries. Mr. W. C. Bexon, M.I.Mech.E., M.I.E.E., engineer and manager to the Board, with ex-Provost Mathew Smith, chairman, Bailie J. Smith and ex-Bailie D. Jones, conveners of the Finance and Engineering Committees, received the visitors and conducted them over the power station, after which they were entertained at luncheon. Later, some members of the party visited the power station at Ayr and the high-pressure transmission lines before returning to Glasgow.

Thus ended a memorable Convention, the arrangements for which reflect great credit on all concerned.

Industrial Electric Heating.

The Possibilities of its Application, and Economic Aspects.

By A. P. M. FLEMING, C.B.E., and J. H. CROSSLEY, B.Sc., Wh.Ex.—*Abstract.*

Contrary to the general belief, the reason for the heating load having become a very important and profitable consideration in some countries (in very many industrial centres in recent years the demand for power for industrial heating has been increasing at an almost incredible rate) is not at once apparent; it is not accounted for by more favourable power rates, since, on the whole, the rates for power in industrial centres in this country compare favourably with those prevailing in the United States; the real reason lies in the close co-operation that has been maintained between the supply authority, the electrical manufacturer and the industrial user, in a careful study of heating problems and their economic solution.

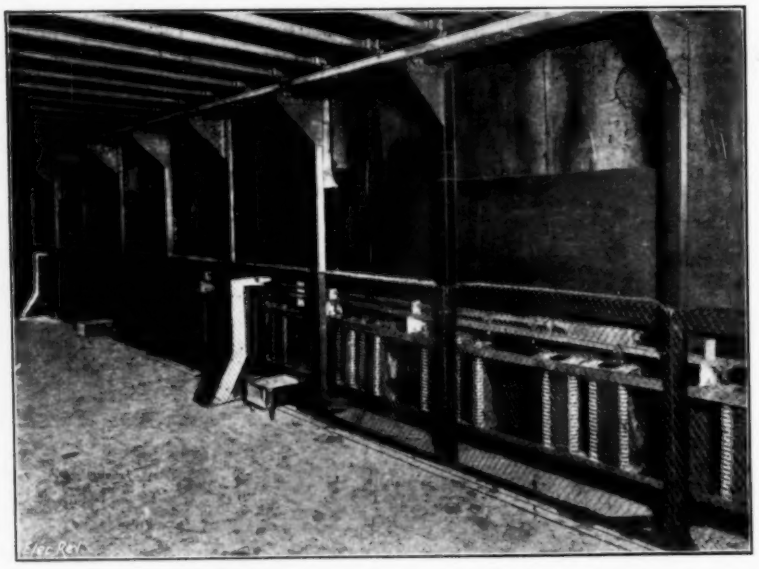


Fig. 1.—Interior of 520-kW Oven for Enamelling Motor-car Mudguards.

The first consideration is the heat insulating property of the type of wall used. Low-temperature installations, up to about 700 or 800 deg. F., usually necessitate the "packed wall" type of construction, and for temperatures above 200 deg. F. not less than 3-in. of insulation should be used; above 400 deg. F., the thickness of insulation should be increased to 4 or 5 in. Installations operating above 1,000 deg. F. are generally designated "furnaces," as distinct from low-temperature "ovens." Above 800 deg. F. it is usual to adopt the brick-built form, and much more efficient insulation is desirable for electrically-heated than for gas, oil, or coke-heated apparatus; above all it is important to keep the amount of "through" metal in the walls to the absolute minimum, for the thermal conductivity of iron is about 600 times that of slag wool or good insulating brick.

Enamel stoving is one of the most important applications of industrial heating. Installations in the motor industry have developed so rapidly that at the present time the Willys Overland Co. alone uses 14,000 kW and the Dodge Co. 17,400 kW for enamel stoving ovens. The Ford Co. has now a heating load of 35,000 kW, a large proportion of which is for enamel stoving, and it is stated that this amount will, in the near future, be increased to 60,000 kW.

Enamel baking is an oxidising process. Air is necessary then, not only to carry away the fumes released, but also to oxidise the enamel. The greater part of this air is required in the early part of the baking process, while the enamel is still "tacky," and it must be clean; electricity heats the air without vitiating it. The very best results can only be obtained by following a heating cycle particularly suited to the enamel used and to the class of articles being stoved, such that the metal warms up at practically the same rate as the enamel on its surface; these conditions can be easily met in an electrically-heated oven.

One of the installations of this type in the Cadillac Works, Detroit, consists of a line of four ovens, each 12 ft. wide by 8 ft. high, and of lengths 70 ft., 100 ft., 100 ft., and 120 ft., respectively. The respective ratings are 390 kW, 520 kW, 520 kW and 450 kW, a total of 1,500 kW for this single line of ovens, and the temperature in each oven is automatically controlled. This installation, operating nine hours per day, stoves four coats on all the sheet-metal parts for 100 cars per day. At ¼d. per unit (the approximate rate charged) this works out at about 6s. per car.

Bread and confectionery baking in this country probably at present offers better prospects of providing a good electric heating load than does any other trade. Baking is not a localised industry, and is but little subject to trade fluctuation; more confectionery is being eaten in this country to-day than ever before, and much baking is done at night and practically none in the late afternoon, so that power can be supplied in most cases at attractive rates. Every feature in which electric ovens excel, particularly their cleanliness and ease of temperature control, are of very appreciable value to the baker; in any case, the cost of "heat" for baking confectionery is almost a negligible item in the total cost of manufacture, and the convenience alone of electric heating outweighs any small difference there may be between the cost of electricity and fuel.

Comparatively small sectional or deck type ovens are being manufactured by several British concerns in one, two, or three tiers, with a rating of 4 to 5 kW per section, although larger sizes are in use, and temperature regulation is obtained by means of 3-heat switches controlling the top and bottom heaters respectively. A baker could start by installing one section and adding others as his trade increased. Each section, of course, being independently controlled, can be used for baking at any desired temperature. This is the ideal oven for a small mixed business. It is economical in use, simple in construction, bakes perfectly, and takes up but little floor space. British-made ovens rated at 50 kW with a number of trays suspended from a chain conveyor by means of which they are carried round the oven are already in successful operation in this country. The heating elements are all mounted on a light frame fitted with wheels, in the oven bottom, and for inspection or repair of an element this frame can be wheeled bodily out of the oven through a removable panel at the front. If necessary, an element can be replaced in 15 minutes without waiting for the oven to cool.

When fitted with automatic control gear the temperature can be maintained indefinitely within limits of ± 1 per cent., irrespective of the load in the oven. Such ovens are already in every-day operation in Manchester, Dublin, Preston, Birmingham, Liverpool, Rochdale, Welwyn Garden City, and Blackpool.

Travelling electric bread-baking ovens (that is, of the type in which dough is continuously fed in at one end and baked bread passes out of the other) are now built in sizes up to a capacity of two tons of bread per hour. Bread baking is often an all-night job, sometimes a 24-hour load, and at ¼d. per unit the cost of electric heating would be low enough to make the proposition attractive from the baker's point of view. About 18 months ago a large electric baking oven was installed on board H.M.S. *Tiger* for experimental purposes, and as a result electric baking ovens are now being installed on the battleships *Rodney* and *Nelson*. Two ovens, each rated at 42 kW, and having a capacity of 300 lb. of bread per batch, have been built for each ship.

Electric furnaces of the metallic resistor type are suitable for annealing, tempering, and hardening steel; annealing brass, vitreous enamelling, glass annealing, &c. An electric steel-annealing furnace at the works of the Keokuk Steel Casting

Co., Iowa, is rated at 400 kW, and operates on the following cycle: "Heat quickly to 1,750 deg. F., hold at that temperature for one hour, drop to 1,500 deg. F., and hold for one hour, heat slowly to 1,550 deg. F. and hold for one hour, cool to 1,200 deg. F. with all air ports closed, then open the air ports and cool rapidly to 600 deg. F., at which temperature withdraw from the furnace." No other type of furnace could duplicate a heating cycle of this nature with anything like the precision with which it can be repeated, day after day, in an electric furnace, while two furnaces, similar but smaller, used by the Chapman Valve Co. for annealing steel valve casings, have been operating at 1,700 deg. F. 24 hours per day, 7 days per week, for 25 months, without once being

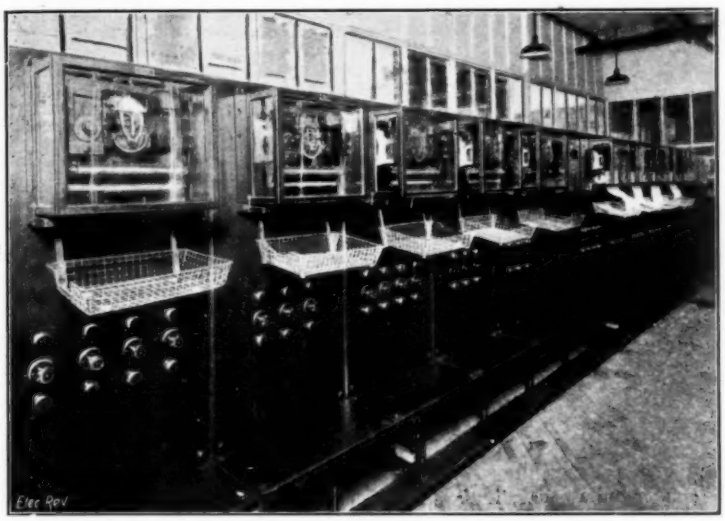


Fig. 2.—Pyrometers Controlling Battery of Ovens; Leeds Northrup Automatic System (Cadillac Works).

shut down. It is certain that no other type of furnace could run continuously at this temperature without having to be shut down at frequent intervals for the renewal of refractories or burners.

The most promising large scale application of electric heat for the steel mill lies in sheet annealing. The Canadian Allis-Chalmers Co. uses a furnace designed for a charge of eight tons of sheet steel (transformer iron) and an average consumption of 340 kWh per ton annealed. The cold charge is put in a hot furnace in the morning and stands all day; power is turned on at night and the charge comes up to temperature (835 deg. C.) in 10 hours. This cycle is used in order to take advantage of the low off-peak power rate as the furnace only consumes power at night. For the heat treatment of heavy steel shafts or cylinders, such as gun forgings, 22 furnaces were built in the States during the war; since then a furnace 10 ft. 6 in. diameter by 105 ft. high and rated at 2,850 kW, has been built to take a load of 143 tons of gun forgings at a charge. Very heavy resistors up to 2 in. wide by ¼ in. thick are used in large furnaces of this type.

Vitreous enamelling is carried out very extensively in electric furnaces for the following reasons: Temperature control is important, and can easily be obtained within very narrow limits; the heat can be uniformly distributed in the furnace and the work need not be turned round; the heat is "clean," there being no specks of soot to adhere to the soft enamel and no sulphur fumes which give white enamel a yellowish tint; the cost of operation and maintenance is low. It is interesting to note that electricity can compete with oil on this class of work in the heart of an oil producing country.

Glass annealing.—The first electrically-heated glass annealing oven to be used for commercial production was installed six years ago in the works of the American General Electric Co. for annealing vacuum tubes, X-ray tubes, &c. A number of other small "lehrs" have since been installed in various lamp works for annealing filament stems, lamp bulbs, &c., and at San Francisco nine 240-kW conveyor type "lehrs" are in use in the works of the Illinois Pacific Glass Co. The average weekly consumption per "lehr" is about 11,000 kWh; about 25 lb. of glass is annealed per kWh. The rate charged for this 24-hour load is 0.4d. per kWh, and at this rate it is stated that the cost of electricity is slightly less than that of coal fuel previously employed.

Economic Aspect.—An industrial heating load, from the power supply point of view, is a desirable one, since it is almost invariably of high power factor, the load factor is usually good, and in many cases it can be arranged to avoid the peak periods, or even to operate as a night load only. In metallic resistor ovens and furnaces, of the type described, the power factor is at least 99 per cent. The load factor varies widely; in general, however, it is good since it pays the user of an electric oven or furnace to keep it continually employed rather than to increase the heating-up losses by using the equipment frequently for short periods only. In general, enamel stoving is a day load during normal working hours, bread-making is a night load, or in some cases a 24-hour load, confectionery a morning and early afternoon load, armature baking a night or 24-hour load, steel annealing a night load, vitreous enamelling a day load, and glass annealing a 24-hour load. The above represent a few broad divisions of industrial heating only, but they suffice to indicate the possibilities of electric heating as a night-load builder.

According to a recent issue of the American *Electrical World*, more than one million kW of electric heating apparatus was in service on "central station lines" at the beginning of 1925, with about 250,000 kW supplied from other sources. During 1925 it is estimated that at least 20 per cent. was added, giving a total of 1,500,000 kW, with a revenue therefrom of about 33 dollars per kW connected. Generally speaking, electricity cannot compete with fuel on a cost basis only, for any specified heating application. When, however, all factors, such as saving of labour and improvement in product, are assessed at their proper value, electrical heating can, in very many industrial applications, effect an appreciable saving in the overall cost of manufacture. Most of the large enamel stoving, vitreous enamelling, and similar important loads in the United States are operating on a ¼d. rate, but taking the average of large and small installations, the rate charged probably averages slightly over a penny.

In this country there are so few installations at present that it cannot yet be stated just what rate should be charged, but a rate of ¾d. to ½d. will be found competitive in the majority of applications. Data are already available on a considerable number of confectionery-baking ovens, and experience has shown that at ¾d. per unit the cost of heat for baking is about 1 per cent. of the value of the goods baked. This refers to an oven baking all kinds of small buns, fruit tarts, slab cake, &c. 2½d. per £1 worth of goods baked does not appear to be excessive, and although this is higher than the corresponding figure for coke fuel it is worth the difference in cost for the convenience that electricity affords. Bread baking must be considered in a class apart; it can be carried out in coke- or oil-fired ovens at a fuel cost of from about 4d. to 1s. 6d. per sack (*i.e.*, per 400 lb. of bread baker), depending on the size of oven, &c. The energy consumption in large electric bread-baking ovens is about 40 units per sack, that is (even at a ½d. per unit) 1s. 8d. per sack. Whilst many bakers might be prepared to pay 1s. 8d. per sack

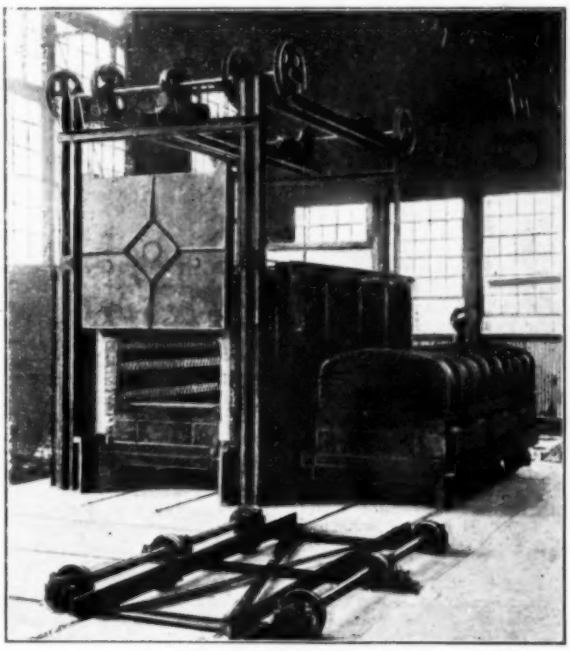


Fig. 3.—Transformer Iron Annealing Oven; 210 kW, 10 tons, 875° C.

as the cost of electricity for bread baking, very few would be disposed to pay more. It should be remembered, however, that bread baking is usually a night load, and in some cases a 24-hour load. One particular baker in this country has already expressed his willingness to install a 400-kW bread baking oven to be operated on full load night and day, providing he can obtain a ½d. rate. Owing to various local circumstances, however, it has not yet been possible to accept

this particular load. There is hardly a town in the British Isles where bread-baking ovens could not be installed at a ½d. rate and large confectionery ovens on a ¾d. rate.

In the majority of applications electricity can compete with fuel on a sound commercial basis where a ½d. rate is available.

The possibilities of the application of electric heating to industrial processes are so varied that in every industrial centre opportunities abound for the conversion of fuel-heating to electric-heating. It is obvious, however, that the industrial user needs educating to the advantages of the use of electricity.

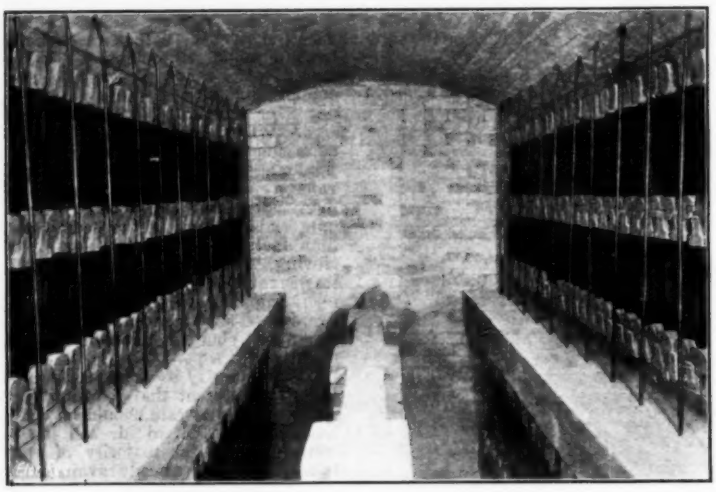


Fig. 4.—Vitreous Enamelling Furnace; 190 kW at 220 V.

Whilst it would, perhaps, be a little premature to organise a campaign in this country, it would probably be sound policy on the part of the electricity supply authorities to make one engineer of their staffs responsible for the cultivation of the heating load; the E.D.A., in conjunction, might compile information on various phases of electric heating, and the electrical manufacturer could assist in instructing engineers in the fundamentals of design and application of equipment. The power supply engineer really holds the key to the situation, since not only does the economic fate of every installation rest in his hands, but he is invariably looked to for guidance by every prospective user of electrically-heated equipment.

Discussion.

Mr. H. W. BOWDEN (Poplar) in a written communication which was read by the President, said he was somewhat disappointed that such a vast subject should have been presented without reference to hot water supply for public and private use. The small amount of domestic heating at present in use only absorbed, under the most favourable conditions, about 30 per cent. of the plant and mains capacity of any undertaking, leaving about 70 per cent. for the development of industrial electric heating, which figure indicated the vast field there was for expansion. The paper dealt to a great extent with continuous processes of heating which, under the very best conditions, resulted in a nominal 100 per cent. load factor, but such consumers were not by any means ideal. Having carried out a great number of experiments during the past year, Mr. Bowden enumerated some of the most important to which he had given attention; for instance, hot water supply for commercial purposes, embodying supplies to public baths and washhouses, public institutions, laundries, hotels, and factories. For this class of supply, being off-peak, only fuel costs need be considered and stand-by coal could be eliminated; the scope was enormous. Again, small steam generators could be used in isolated parts of factories where small quantities of steam were required intermittently and with hot water available at 150 deg. F., in the storage tanks, steam could be raised at low pressure in a very short time by using electricity from the power circuit. Many industries, too, required special drying chambers for their processes and almost invariably steam was used for this purpose; he had, however, successfully introduced electric radiators into a paint factory in Poplar for drying colour. There was likely to be a big development in the importation of frozen meat from Australia and New Zealand in the near future, and there was every prospect of a considerable off-peak load being developed for de-frosting such meat. The authors appeared to have devoted their energies to pushing the claims of the rotary baking oven in preference to others; it had been evolved from American practice, but very little progress had been made with it, largely due to the antipathy of bakers to moving machinery in the bake-house, the high cost of installation, and the fact that it was not adaptable for the production of all types of loaves. However, the best type of oven would eventually evolve itself and attention should be concentrated on the general question of baking bread, confectionery, &c., by electricity. Finally, Mr. Bowden urged the importance of making one engineer on the staff responsible for the cultivation of the heating load.

Mr. T. ROLES (Bradford) was not at all sure that baking would be a night load because, at any rate in Bradford, they seemed to be doing all the baking in the day time. He had had experience with the first Westinghouse conveyor-type of bakers' oven which was made and a Bradford baker experimented with it so successfully that he kept it and eventually he bought another. Electricity was at first supplied at a flat rate of 1d. per kWh and the revenue from the one oven amounted to from £100 to £150 per annum; the price, however, had now been reduced to ¾d. per kWh. One of the biggest advantages of electric baking was that the baker was able to get about 25 per cent. more product from the same amount of raw material, and that was a point which should be made much of in pushing this class of business. Whilst bakers in Bradford had shown considerable interest in the subject, they were so convinced that steam would do all they required for bread baking that it would be a little difficult to compete, except for such things as fancy cakes and confectionery. Another important point, of course, was the ease of control of temperature. He not only supported the suggestion that a special member of the staff should be appointed to push industrial electric heating, but would go farther and suggest that facilities should be afforded to these departmental heads from all over the country to meet frequently during the year and exchange ideas; this was done in America, and very often the men travelled thousands of miles to the meetings.

Mr. W. F. T. PINKNEY (Newcastle-on-Tyne Supply Co.) suggested the compilation from all possible sources by the I.M.E.A. of information regarding electric heating, and arrangements for keeping this information up to date so that it would be available for engineers specially developing the industrial heating load. There were, he said, many applications of industrial heating of which very little information was at present available.

Mr. P. P. WHEELWRIGHT (Blackburn) expressed the view that too much was being said as to electricity being dear for industrial heating. At the same time the special advantages in the way of cleanliness, increased product from the same amount of raw material, &c., were being stressed and surely those advantages were worth paying a little extra for because in the final result industrial electric heating was cheaper than other forms, irrespective of the basis of cost of fuel. Therefore, he deprecated papers being read which emphasised that electricity was expensive. It was an exceptional case for industrial electric heating to be abandoned after trial, so that those who had had experience did not mind paying the slightly extra cost for fuel because of the advantages which were obtained.

Mr. F. W. PURSE (West Ham) welcomed the paper as he was the instigator on the Council of its being prepared. He strongly supported the suggestion of Mr. Roles that, not only should engineers be specially appointed by municipal electricity departments to develop this load, but that opportunities should be given to them to meet frequently, which he intended to follow up so far as the London district was concerned and see if something could be done. One of the difficulties was the hesitation of people to take a new step; an instance was the Municipal Technical Institute in West Ham, wherein he had been endeavouring to get an electric oven installed, having been told by the master bakers that if apprentices could be trained to use electric ovens it would facilitate their general introduction into the trade. For two years he had an estimate for £400, but each time, on the score of economy, the proposal had been turned down; fortunately this year he had succeeded. Again, there was too much hesitation in installing electric cookers in schools where girls were taught cookery, and one of the superintendents of such schools had told his lady demonstrator that girls were not trained as domestic servants in these days. The answer was that girls would have a home of their own one day, and ought to know how to handle an electric cooker. There were also many other smaller applications of electric heating which needed development, one particular case being a soap works where it had been found that only by electrical means could the soap be kept in a certain plastic condition for a particular operation. Finally, Mr. Purse said that for his own house he had succeeded in getting a little electric heater into which the ordinary hair-curling tongs could be placed and his wife had found this more satisfactory than the electric curling tongs. This little device had been made for him by Mr. Barfield, of the Electric Furnaces Co. It was imperative that the education of the public in the use of electric heating for all purposes should be persevered with.

Mr. A. NICHOLS MOORE (Newport, Mon.) drew attention to one application of electric heating which was new to him before it was tried in Newport with considerable success, due to a suggestion from one of the staff. It was the application of electric heat to maintain at a reasonable temperature the tar in macadam plant, especially in cold weather, and to prevent the tar hardening on contact with the cold stones, thus facilitating the mixing of the tar and the stones. The heating elements were first applied to the under side of the shoot, reflector type elements loaded to 1,000 watts being connected in parallel to a common bus bar running down the shoot and operated through switches so that the temperature could be

regulated. Experience had led to certain improvements and it was proposed to put in 26 elements, each of 600 watts, with greater facility for the regulation of temperature, and they were also going to lag the protecting cover of the shoot. The cost worked out roughly at from 7d. to 1s. 1d. per hour at ¾d. per kWh. In Newport also they had had some experience with electric baking and he was surprised that nothing had been said either in the paper or the discussion as to the comparative cost of electricity and gas for this purpose. His experience seemed to be that it was economical to use electricity in preference to gas, if electricity cost ¾d. per kWh and gas 1s. 1d. per therm, with which bakers were satisfied in Newport. At present, however, the cost of putting in baking ovens was considerable and he had succeeded in producing small pastry ovens which were sold on hire-purchase terms, his idea being that when the pastry cook got one of them and was satisfied he would later on go in entirely for electric baking of bread, &c.

Councillor J. THICKETT (Walsall) expressed the hope that those present at the meeting would not go away and take no further action in respect of industrial electric heating. There was too much hesitation on the part of municipal electricity supply committees in pushing out into new lines of business; there were enormous opportunities for industrial electric heating and already it had been introduced in Walsall for buckle making with electric welders. He congratulated the Metropolitan-Vickers Co. on the work it was doing.

Councillor W. JOWETT (Aylesbury) said he was connected with one of the largest printing and binding firms in the country, which employed 1,250 hands and sent deputations to America every two or three years to see what was going on. At their Aylesbury works the metal used for 15 linotype and monotype machines was now to be heated by electricity instead of gas. In the binding department there were two to three dozen electrically-heated glue wells and in the printing machine department heaters were being introduced consuming about 650 watts per hour. In first-class printing work it had been necessary hitherto for one side of the sheets to be dried, which took time, but by the use of heaters considerable time was saved in this respect.

Mr. T. H. LEAK (General Electric Co.) spoke of the difficulty of getting cookery schools to install electric cookers and mentioned the case of one mistress who, when asked to put in an electric cooker, said she did not like electricity and would not even use it for lighting. As to the cost of electricity he knew one baker in North London who was perfectly satisfied with 2d. per kWh, but that was a special case and generally the charge would have to be ¾d. to 1d. per kWh for ordinary baking. Generally speaking bread baking was an off-peak load, although in some cases it might be done in the day time.

Councillor J. ORMEROD (Blackburn) said that the Blackburn Electricity Department had appointed a consumers' engineer and he recommended all electricity supply departments to do the same, and to pay a fair salary because it was amply repaid in the extra business obtained.

Mr. A. P. M. FLEMING, replying to the discussion, said that the de-frosting of meat mentioned by Mr. Bowden was very interesting, and he had heard of the use of a high-frequency induction furnace for a similar purpose. It was quite true that the comparative cost of actual fuel for industrial electric heating became insignificant when the other advantages of using electricity were taken into account. He agreed, of course, with the suggestion that there should be one engineer in a municipal supply department to deal with these matters and the compilation of data as suggested by Mr. Pinkney was a matter in which the manufacturers would help in every possible way. A good deal depended on publicity and propaganda, but personally he had a feeling that for large baking ovens it would be difficult to get more than a 1d. rate. Mr. Nichols Moore's suggested use of electricity in connection with tar-macadam plant was quite new to him. As to the comparison between gas and electricity the paper had suggested ¾d. per kWh for pastry bakers as being a suitable figure. It might, however, interest Mr. Nichols Moore to know that in Preston one large firm of bakers had recently replaced a new gas oven by an electric oven.

Annual Report and Accounts.—*Abstract.*

The annual general meeting of the I.M.E.A. was held in Glasgow on June 18th. The Council's report for the period June, 1925, to June, 1926, indicates that the activities of the Association increased during the past twelve months and, much useful work has been accomplished.

During the year six municipal electricity supply committees have joined the Association: Crook, East Ham, Guildford, Harwich, Scarborough, Workington. The total membership now stands at 225, representing a population of well over 22 millions and 84 per cent. of the authorities eligible for membership.

During the year 10 Council meetings and two special Council meetings were held in London. The activities of some of the Committees are outlined below:—

Electrical Apparatus Committee.

Since the 1925 Convention the above-named Committee has been concentrating most of its attention on household electric cookers. In 1923 the British Engineering Standards Association, on which the I.M.E.A. was represented, issued a specification relating to household cookers which offered a valuable basis for discussion and stimulated keen interest. The Committee issued a questionnaire to the members of the I.M.E.A. in order to ascertain:—(1) The opinion of supply engineers as to the desirability of the domestic electric cooking load; (2) the total number of cookers in use in the country; (3) the possibility of the standardisation of design, and to obtain ideas regarding co-operative purchase with a view to lowering prices.

Opinions were generally very much divided, and it was felt that the Committee should in the first place study the principal makes of cookers on the British market. Accordingly the Committee inspected in detail, one at a time, cookers of thirteen different makes.

The Committee is convinced that as a result a great deal has been, and will be, done by the manufacturers to improve the cookers and also to bring about standard conditions. The observations of the Committee upon certain leading features which it is considered should be incorporated in the design may be briefly enumerated as follows:—

Back plate, with or without plate rack, should be enamelled, at least at the front; it should be capable of being easily removed, preferably from the front, or be so hinged as to allow the back plate to be lowered towards the front of the cooker, to allow the top plate to be raised for changing elements, &c., without the necessity of drawing the cooker out from the wall, against which it may be placed.

Cooker top plate should be hinged at the back so that it may be lifted up from the front and held by a stop in a more or less vertical position, so that repairs to hot plates, elements, &c., can be carried out without the necessity of holding or otherwise propping up the top plate. It is also necessary that the top plate shall be fastened at the front to prevent irresponsibles from being able to lift easily the top plate and expose themselves to danger.

Hot Plates.—The Committee does not consider it advisable to recommend any particular design so far as the elements and formers are concerned. An interesting hot plate, which may probably be developed to a greater extent in the future, is constructed on the lines of the open type, but with a thin cover over the elements, which, although giving the appearance of a totally-enclosed hot plate, is not so, but offers the great advantage that spilled liquids cannot possibly come in contact with the elements.

The oven is a very sound, substantial, and satisfactory portion of the cooker, and, speaking generally, the elements give very little trouble. The interior should, so far as is practicable, be enamelled, and the sides should be renewable without interfering with the lagging. Joints, if any, at the bottom of the oven should be such that it is impossible for liquids to percolate down into the lagging below the bottom of the oven; this defect has proved disastrous in many cases due to liquids permeating the lagging material (often slag wool), forming acids and attacking the steel casing. The bottom of the oven should slope slightly and a tap should be provided to allow liquids used in washing or otherwise to run away freely to the front.

Oven Elements.—Considerable progress has been made in the general design of oven elements, particularly the method of connection and ease of replacement. Sub-divided contacts are a very important point, and the provision of a complete set of spare elements with every cooker is recommended.

Connections.—In the past too many different sizes and kinds of screws and nuts have been used for connections, &c.; one or two makers have agreed to standardise one size.

Oven Doors.—A great deal of useful attention has been given by manufacturers to the design of oven doors, particularly closer fit to prevent heat leakage.

Thermometers.—There still appears to be a division of opinion as to the necessity of thermometers, but the Committee considers that the majority of persons prefer them; however, a very expensive and accurate thermometer is not necessary so long as some thermal indicator is provided which will act as a guide to the temperature in the oven.

Fuses.—Most of those inspected were considered quite satisfactory; fuses, if possible, should be placed in a casing to prevent the possibility of access by children; replaceable fuse carriers should be interchangeable to allow of spare fuses being kept and replaced by the user if necessary; a spare fuse carrier should be supplied with each cooker, and provision made for keeping the spare carrier in the cooker fuse housing.

Earthing.—Insufficient attention has been paid to this matter in the past, although practically all the cookers examined were fitted with one earthing terminal. In some cases the terminals were connected to metal which was only loosely connected to the rest of the cooker. All the metal work, including the hob and any metal top boiling plates, should be electrically connected to an earth terminal, efficiently connected to the frame of the cooker.

The Committee feels that to bring about standardisation small changes will take place, and that electricity supply authorities can have every confidence in commencing or increasing the development of the British-made household cooker so far as hire and sales are concerned.

Bulk Supply Committee.

In accordance with a resolution passed at the last annual meeting at Brighton, the Council appointed a committee to consider the conditions under which bulk supplies were given and received. The complexities which occur in preparing a formula for use when negotiating for such supplies were quickly appreciated, and as it appeared that no definite progress could be made until the Electricity (Supply) Bill, 1926, was disposed of, it was decided meanwhile to suspend further meetings of the Committee.

Overhead Lines Regulations Sub-Committee.

This Committee has submitted a report embodying a new code of regulations for overhead lines in relation to low-voltage distribution, which the I.M.E.A. Council has approved and forwarded to the Electricity Commissioners :—

To establish a standard of safety to the public. The materials to be used to comply with the British Engineering Standards Association's Specifications.

The factor of safety for materials and construction to be fixed to meet the circumstances which prevail in the areas having the most favourable conditions; such factors of safety to be increased where conditions and experience indicate a higher basis is warranted. The calculations to be based on a wind pressure of 25 lb. per sq. ft. and on 0.6 of the area exposed to wind pressure and the ultimate strength of the material. In calculations for clearances, elasticity of materials need not be taken into account.

Material.	Factor of Safety.
Wooden Poles	8
Steel Poles	4
Copper Conductors	4

The line conductor in no instance to be smaller than 10 S.W.G. The construction of lines to be in accordance with the tables provided. The clearance of lines from the ground :—(a) Along or across public highways, a minimum height of 17 feet. (b) Along private roads, across drives and along footpaths, a minimum height of 15 feet. (c) Away from highways, over fields and along hedges, a minimum of 12 feet.

Distribution lines fixed to or passing buildings not to be placed nearer than 4 ft. to such buildings if uninsulated; where lines pass within 4 feet of buildings, insulated lines having similar insulating qualities to p.b.j. lines to be used.

Steel poles to be separately and effectively earthed.

Service lines fixed to or passing buildings not to be placed nearer than 4 feet to a window, door or opening if uninsulated.

Where a line is placed within 4 feet of a window, door or opening, insulated wires having similar insulating qualities to p.b.j. to be used for that part of the line.

Uninsulated service lines attached to buildings to have a minimum clearance from the ground of 10 feet. Where the service line is less than 10 feet, insulated wires to be used.

The clearance between Post Office and electricity supply bare overhead lines to be not less than 2 feet. Where 2 feet cannot be arranged, p.b.j. to be used and a clearance of not less than 6 inches to be allowed.

The responsibility of conforming to low-pressure overhead line regulations to rest with the electricity supply authorities.

Wayleaves Sub-Committee.

In May, 1925, a conference convened by the Electricity Commissioners was attended by representatives of the above Sub-Committee, together with representatives of the power and railway companies, to discuss the conclusions arrived at with regard to the crossing of railways by electric power lines, as a result of a series of meetings between representatives of the Electricity Commissioners, the railway companies and the Post Office. The conference was adjourned to give the I.M.E.A. an opportunity of considering with the power companies the terms to be embodied in a standard railway wayleave agreement.

I.M.E.A.—E.L.M.A. Sub-Committee.

The Association received a communication from the E.L.M.A. in February, 1926, asking whether definite guarantees of performance of electric lamps in street lighting service would lead to the freer use of electricity for such purposes. A set of model conditions, including life guarantees, was presented by E.L.M.A. and a further meeting is to take place.

Electricity (Supply) Bill, 1926.

The interests of local authorities are being carefully investigated and every endeavour is being made to obtain the insertion of a clause in the Bill to enable all local authorities to possess wiring and selling powers; at the present time only about 50 per cent. of the undertakings belonging to the I.M.E.A. possess such powers.

In May a special general meeting of the Association was held in London to consider the amendments prepared by the I.M.E.A.-A.M.C. Sub-Committee and steps are being taken to have them moved by members of Standing Committee "C" of the House of Commons which has the Bill under consideration.

Relief of Rates.

This matter was taken up with the Electricity Commissioners and although the Council is strongly against the principle of relieving the rates from the profits of electricity supply departments and would like to see a clause in the new Bill prohibiting it, it is satisfactory to note the limitation proposed in the fifth schedule of the Electricity (Supply) Bill, 1926.

Shipbuilding Regulations.

In June, 1925, draft Shipbuilding Regulations were published and those electricity supply undertakers situated in shipbuilding areas were strongly opposed to the clause dealing with the voltage of supply which was to be enforced for use on board ship during the carrying out of temporary work and repairs. As the result of steps taken, it is thought that the position has materially improved.

Expenses of Members Attending Council Meetings.

The Finance and General Purposes Committee could not recommend the payment of members' expenses attending Council meetings, as such payment would amount to approximately £1,500 per annum and be practically equal to the whole of the annual revenue of the Association on the present scale of subscriptions.

Annual Accounts.

The statement of accounts as at March 31st, 1926, shows that the income (£2,595) was about £145 greater than in the previous year; the surplus of income over expenditure was £462, against a surplus of £169 last year.

Annual Dinner.

The annual dinner was held on Thursday evening, June 17th, in the St. Andrews Halls, Mr. R. B. Mitchell (President) being in the chair.

Mr. D. N. DUNLOP (British Electrical and Allied Manufacturers' Association), proposing "The I.M.E.A.," said that as director of the B.E.A.M.A. he was supposed to sit in his office in Kingsway and wield some magic wand over prices. As a matter of fact, he did nothing of the kind. The electrical manufacturers had asked him to spend some of their money on research, on standardisation, on grants to the E.D.A., and for other purposes of that nature for the good of the electrical industry in this country. On the Continent there were many cartels and rings, but if any Britisher attempted to make a ring in this country he was not regarded with sweet complacency. In fact, at one time he believed the buyers of electrical machinery dictated the price, and when one went to sell electrical apparatus, as he had done, one was always told the price was 20 or 25 per cent. too high. In those days, the electrical machinery manufacturers of this country were paying an average of 1.65 per cent. on the capital invested, and many manufacturers were losing money rapidly. There was no branch of the industry but was affected, by a reflex action, by that situation because, after all, every branch of the industry was closely related and what affected one eventually affected all the others. If orders went to the Continent every time our prices were a little bit higher than those of foreign competitors, the result would be that we should have no technical skill in this country available in time of emergency; we had already found out the importance of that. The B.E.A.M.A., however, had many friends in the I.M.E.A., and his association with the engineer members of the I.M.E.A. had taught him what a splendid set of fellows they were. If there was any doubt in the mind of anybody as to the success of municipal trading, it should be dispelled when he stated that 64 per cent. of the electricity supply output of this country was from municipal undertakings. The invasion of this country by the foreigner was a pet subject of his. They had lost Leicester, but he hoped they would not lose Edinburgh. He hoped it would be possible to keep as much business, under present industrial conditions, in this country as possible and so employ our men. It was to be hoped that such action would be taken as would make it impossible for business to go abroad. Whatever they might know about rings, the foreigner could teach them far more than they knew and he hoped that British buyers would not encourage foreign rings, knowing that those foreign countries had protective walls around them. Whatever rings they might set up in this country, they were always open to foreign competition. There was a great deal of co-operation between the I.M.E.A. and the B.E.A.M.A.; there was a joint Committee, and the manufacturers appreciated the work that had been done in exchanging ideas and co-operating in the best interests of the supply and manufacturing sides of the industry. He hoped the Government Electricity Bill—upon which the municipalities had expressed their views rather late—would be passed in such a form that it would please everybody and enable a rapid development of electricity supply to take place. Recently he had had the privilege of meeting representatives of the contractors, wholesalers, and manufacturers of all grades of machinery, together with representatives of the I.M.E.A., and as the result of that conference they decided that there was an opportunity to bury the hatchet and to work together for the advancement of the industry in a new way. As a result, a clause had been drafted for inclusion in the Electricity (Supply) Bill which would enable the supply undertakings to have trading powers. He looked forward with great pleasure to the results of that agreement and expressed the wish that all sections would co-operate in the same spirit.

The PRESIDENT, replying to the toast, said the I.M.E.A. now represented 84 per cent. of the municipalities eligible for membership, and these municipalities represented a population of 22 million people. The Electrical Association for Women had held a very successful meeting during the Convention in Glasgow; that Association was being carried on very successfully in the Glasgow district, and he was glad to learn that other branches were being formed in different districts. Although the Convention had been held under a disadvantage owing to the coal dispute and the general strike, the original plans had been carried out, with one exception. Last year, at Brighton, there had been a record attendance, but the number this year was not far short, and whilst the coal crisis had cast a shadow over the country it had had the effect temporarily of removing another shadow from Glasgow in the pall of smoke that usually hung over the city. The Electricity Department was doing its best to rid the city of this evil in normal times.

Alderman W. WALKER (Manchester) proposed "Ladies and Guests," and coupled with the toast the name of Dr. Ferranti, the principal guest of the evening, to whose work for the industry he paid a high tribute.

Dr. S. Z. DE FERRANTI said that that Convention marked a turning point, *i.e.*, the insistence of the ladies upon the all-electric home. When the ladies made up their minds to that idea, they would get it, and that meant that whatever difficulties there were, the engineers would have to solve them. The women of the country generally were rapidly coming to the idea that their homes were worked upon a far too laborious plan. What they wanted now was a complete service, and he knew of no means of getting complete service in the home to fulfil all their physical requirements, other than electricity supply, because it gave the greatest cleanliness and the minimum of labour. The joint meeting with the Electrical Association for Women was a sign of the times; that Association would do much to raise the standard of knowledge of the uses of electricity in the home, which must result in an ever-increasing use of electricity.

The I.M.E.A. Exhibition.

(*Concluded from page 977.*)

IT will probably prove interesting now to refer to some of the more notable features of the exhibition. In our issue of June 18th, p. 935, we dealt fully with a new "Cosmos" product, the new type of boiling plate; constructed on somewhat similar lines is the "Sadia" fast hot plate, which was exhibited by Messrs. SADIA ELECTRICAL APPARATUS. In this device the elements are very near the surface of the plate and completely embedded, and it is claimed that they transmit their heat to the top in a very short time. The heating surface is machined flat, so that the best results are obtained with utensils with machined bottoms. As the resistance wires are completely protected, no oxidisation or "bright spots" occur. The plate is provided with 3-heat control, and is made in varying sizes, shapes, and loadings to meet the requirements of all electric cooker users. It is claimed that the plate may be entirely immersed in water without damage to the elements or other parts in any way.

An electric toaster, in which the bread is automatically removed from the close proximity of the elements and the energy switched off when the toasting is completed, proved of great interest, and was shown by the HOTPOINT ELECTRIC APPLIANCE CO., LTD. The time required for the toasting is set by means of a lever which reaches its original position at the end of that time, when the removing operation takes place. The toasted bread is kept warm for a time after removal in an "oven" over the toasting elements. This firm also exhibited an interesting appliance known as the "hotplate booster," which incorporates an immersion heater for improving the efficiency of the present-day electric cooker hob. It consists of a vertical pillar mounted on the side of the cooker, and fixed to the head of this is a switch, from which projects a swivelling arm and immersion heater combined. When in the "out of use" position, the immersion heater is swung out of the way and takes up a position which prevents the switch being closed by accident. To bring the booster into use, the arm is raised and swung over the vessel and then lowered into it. The action of lowering the immersion heater into the vessel closes the switch, and in the reverse manner lifting the immersion heater out of the vessel automatically opens the switch. It is claimed that the time taken to boil water with the booster is shorter than that taken with a standard electric kettle of the same loading.

The model V vacuum cleaner of Messrs. ELECTROLUX, LTD., attracted considerable attention. In this machine the motor and dirt container are arranged as one unit, which rests on a pair of "skates." A long flexible suction tube enables cleaning operations to be effected over a considerable area without moving the body of the machine.

Included in the exhibits of the FALKIRK IRON CO., LTD., was a portable electric baking apparatus, the "Falco-Girdle," which is a departure from the usual design of this type of apparatus. The top of the device is a machined plate, and directly on this the food to be cooked is placed. It is suitable for baking such eatables as scones and oatcakes.

A new model of electric cooker, H 5,700, was shown for the first time by the GENERAL ELECTRIC CO., LTD. This has some new features; it is built with a cast-iron frame and a sheet-steel body, double cased and lagged. The hob accommodates two open-coil boiling plates and a griller or toaster. Under the plates are provided polished reflectors which can be removed for cleaning without raising the hob-table. Another feature of the exhibit was a new fitting of the totally-enclosed type. The bowl is not attached to the metal top by screws, but is suspended by flexible cords; when it is desired to clean the interior or to change a lamp, the bowl is released by a simple device and gently runs down to a convenient distance under the control of a brake. Similarly when the work is completed, the bowl is easily wound up; it cannot be dropped, nor are there any screws to lose.

In addition to the cooking apparatus built for Dr. S. Parker Smith by Messrs. ARCHIBALD LOW & SONS, LTD., this firm exhibited some new designs of wash boilers. Model No. 355, which has a capacity of 10 gallons and a loading of 3 kW, is heated by a "Highlow" immersion heater contained in a special heating chamber at the bottom of the boiler. It is mounted on suitable legs and fitted with a conveniently-placed draw-off cock.

A useful exhibit was that of MESSRS. KELVIN, BOTTOMLEY AND BAIRD, LTD., who showed their "Kelvite" unit system of heating and ventilating, designed primarily for use on board ship, so that the ventilation and heating of any compartment is entirely under the control of the occupant, independently of all others. A "Kelvite" unit is installed in each cabin and connected to the main ventilation system. Each unit consists of a small robust motor-driven fan built in a housing in which is incorporated an electric heater. A special switch gives four controls: fan off; fan on, low heat; fan on, cold air; and fan on, full heat. An adjustable delivery nozzle allows fresh air to be delivered in various directions as desired by the occupant.

A novel safety kettle was shown by the BRITISH ELECTRIC TRANSFORMER CO., LTD. It contains a switch with a spring handle, which, when the kettle is being heated, is prevented from moving by the surface of the table; directly the kettle is lifted the switch flies "off," and remains off when the kettle is set down again, unless it is purposely held in the "on" position. Thus if the kettle is emptied without removing the flexible connection, it is impossible for it to be burnt out by accident.

An unofficial, but extremely interesting, exhibit at the Convention was the Henley demonstration car, which has been designed to tour Great Britain, bringing samples of Messrs. W. T. HENLEY'S products to the door of actual or prospective customers; the opportunity was seized to "introduce" it to the electricity supply industry. The car comprises a 2½-ton Albion chassis, specially designed for the purpose, with a radiator and bonnet to give a stream-line effect, and a handsome body finished in dark maroon; a separate vestibule compartment is provided for the driver, with accommodation for personal effects, &c., and the interior is lighted with five ceiling lamps, in addition to strip-lights in the showcases which are fitted round the sides. The tires, of course, are Henley's.

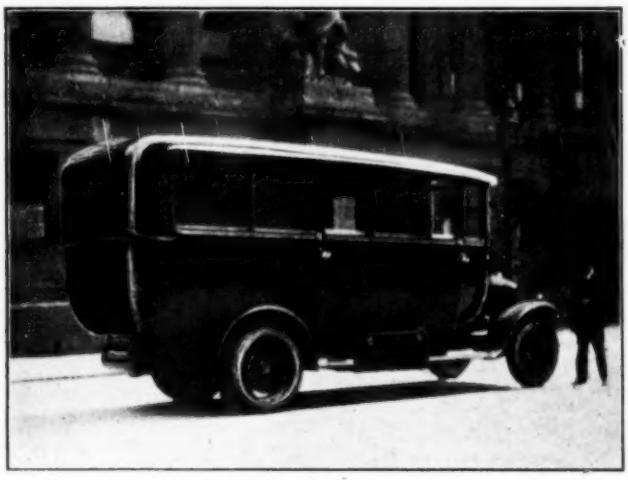


Fig. 9.—The Henley Show-car.

Fig. 10.—Interior of Car.

The chief features of the equipment are the "Isco" ironclad service cutouts, "Ruptor" ironclad switches, and industrial type lighting boxes; there are also samples or models of Henley dividing boxes, distributing pillars, link disconnecting boxes, overhead line taps, aerial fuses, and the Henley wiring system, and a sample board of brass contact blocks, showing unit pillar conductor fittings in various stages of manufacture from the solid rod to the finished article—it being a speciality of the company to use no castings but only pressed metal for fittings which are to carry current. Photographs of mansions wired on the Henley system added a decorative element to a well-thought-out exhibit, which attracted a great deal of attention.

The Electricity (Supply) Bill.

The Proceedings in Committee.

(*Continued from page* 980.)

CLAUSE 6 (new selected stations) was considered when Standing Committee C of the House of Commons met on June 21st. Sir Robert Sanders presided.

Sub-section (1) of the clause states that "The Board may make arrangements with any authorised undertakers, or with any company, or person, not being authorised undertakers, for the provision of such new stations as are required by the scheme." Col. W. ASHLEY, Minister of Transport, moved to leave out the words "or with any company, or person, not being authorised undertakers, for the provision of such new stations as are required by the scheme" in order to insert "in whose area of supply, or in the neighbourhood of whose area of supply, any new generating station required by such a scheme is to be situated, or, failing such authorised undertakers, with any other company, or person, for the provision of such station." He said that it seemed quite fair that a preference should be given to the authorised undertakers in the neighbourhood of whose area of supply the new generating station was to be situated.

Mr. G. BALFOUR (Hampstead, U.) said the amendment went a long way to meet his objections, but he urged that the words "or, failing such authorised undertakers, with any other company or person, for the provision of such station" should be replaced by the words "or an undertaker to be constituted by the order." He said that the responsibility would thus be thrown back upon the Board, and, having failed to find an undertaker, the Board would be empowered to erect a station under a Special Order, or under a Special Order there would be delegated powers to an undertaker if so determined.

After some discussion, the ATTORNEY-GENERAL agreed to the omission of the words only, and the amendment, as amended, was agreed to.

Sir D. HOGG moved to insert words providing that the Central Electricity Board, or any company, or person could be authorised to provide a station by the Electricity Commissioners.

Mr. HARDIE (Glasgow, Springburn, Lab.) protested against this amendment, which was, however, carried by 30 votes to 10.

Mr. ALEXANDER (Sheffield, Hillsbro', Lab.) moved to make it mandatory rather than permissive for the Board to operate a new generating station which it had itself established. Public ownership and control was, he said, for the benefit of the industry and for the benefit of the consumers.

Sir D. HOGG opposed the amendment, which was rejected by 35 votes to 11, after which Clause 6, as amended, was carried by 39 votes to 11.

The Committee then adjourned.

On June 22nd, Lt.-Col. MOORE-BRABAZON moved an amendment to provide that the owners of a selected station should be obliged "to operate the station so as to generate such quantity of electricity at such rates of output and at such times as the Central Electricity Board may direct, and to conduct such operations with due regard to economy and efficiency." From a strategic point of view, he said, the general control of the Board must remain; as he visualised it, at first a selected station would carry a standard and straightforward load, but in an industrial district with several stations it must be looked on as a whole unit of generation, similar to the big system of generation which existed on the North-East Coast, where a load adjustor tried to arrange things as economically as possible. All the amendment did was to say clearly that there should be no pettifogging interference by individuals with the generating stations belonging to the undertakers who were running them.

Sir J. NALL (Manchester, Hulme, U.) moved to leave out the words "at such rates of output and at such times as the Board may determine" in order to insert the words "as may be required for the purposes of the scheme," beyond which the owners should be at liberty to operate according to the requirements of their own business.

In reply to a request from Mr. G. Balfour, Lt.-Col. MOORE-BRABAZON said that it was obvious, as this particular scheme started, that selected stations would not be selected for peak load alone. As the scheme grew, the selected stations would carry as much load as possible, so that they would, at first, be base-load stations; as the scheme developed, it might be possible to put more and more load on still more efficient stations as they increased or became built, so that at some time they might become peak-load stations. It had been agreed that "once a selected station, always a selected station." Hence the Board was responsible for those stations whether they were carrying a base load or a peak load, and they were protected as regarded both running and capital costs.

Col. W. ASHLEY, in reply to a question, said that the Board contracted to take the whole of the output of a selected station, and the price was to be either the price of the electricity generated at that station, adjusted to load factor, or, alternatively, the general price at which the Board was selling to distributors in the district, whichever was the lower. There was also a guarantee that for seven years in no circumstances should the price to owners of a selected station be any higher than the price at the present moment.

After further debate, Lt.-Col. MOORE-BRABAZON declared that Sir J. Nall was trying, as he had been for the last month, to deprive the Board of any effective power whatsoever.

Sir J. NALL's amendment was negatived, and Lt.-Col. Moore-Brabazon's amendment was agreed to.

Sir J. NALL then moved another amendment designed to secure that the Board should not give any directions which would interfere with the efficient working of stations belonging to owners of a selected station, or with any contractual obligation of those owners with regard to private generating stations, but his proposal was opposed by Lt.-Col. MOORE-BRABAZON, who said he would resist an amendment to curtail the activities of the Board.

Sir J. NALL retorted that the sole object of Lt.-Col. Moore-Brabazon appeared to be to facilitate arbitrary actions by the executive.

The amendment was negatived, as were a number of others moved by Sir J. Nall.

Sir D. HOGG moved an amendment to provide that the price to be paid by the Board to the owners of a selected station for electricity generated thereat should, unless otherwise agreed, be the cost of production, which was agreed to.

Sir J. MARRIOTT (York, U.) moved to omit the provision in the clause which placed a proper proportion of the Board's expenses on the owners of a selected station.

Sir D. HOGG explained that the expenses of the scheme had to be debited out of the total electricity supplied by the Board. Owing to inter-connection, there need be much less stand-by plant erected by each owner of a station, and his capital expenditure, therefore, would be largely reduced. If the Bill were to pass now, then by 1932, when the scheme ought to be in operation on a pretty large scale, the total cost of transmission lines and other standardisation charges, including substations and things of that kind, up to that time would be, roughly, £8,000,000, whereas the saving in capital expenditure to the owners of existing stations, compared with what they would have had to spend if the Bill were not passed, would not be less than £21,000,000. The cost of the transmission lines was not as much as the amount saved in capital expenditure to the owners of existing stations; that being so, it would be unfair to say that the owners of the selected stations were to get all the advantage of the scheme, and at the same time to say that the cost of the scheme was to be debited exclusively to the areas of the non-selected stations. The cost should be spread over all those who shared in the advantages of the scheme.

The amendment was negatived, and the clause, as amended, was agreed to.

Clause 8 deals with the construction and acquisition of main transmission lines. The Committee agreed to an amendment, moved by Sir D. NEWTON (Cambridge, U.), providing that where the Board acquired a main transmission line, and by reason of the use of it by the Board, alterations in apparatus of authorised undertakers connected with the line were necessary, the Board should defray reasonable expenses incurred by the undertakers.

An amendment moved by Sir D. HOGG to provide that a main transmission line belonging to the owner of a private generating station should not be acquired without the consent of the owner was also carried, and Clause 8, as amended, was agreed to.

The Committee then adjourned.

On June 24th, Clause 9, which contains provisions for the standardisation of frequency, was dealt with.

Sir F. HALL (Dulwich, U.) moved to substitute for the Board, as the authority to require undertakers to amend or alter the frequency of their station, "the scheme under Clause 4."

Sir D. HOGG said that the amendment would make nonsense of the clause. A scheme for the standardisation of frequency had already been passed in Clause 4, and the only object of Clause 9 was to give authority to the Board to require the undertakers to alter the frequency as might be required.

The amendment was negatived.

Mr. TOWNEND then moved an amendment to make the clause applicable to any generating station, instead of only to selected stations.

Sir D. HOGG said that the amendment would not increase the power of the Board, and there was no reason for giving that power, because no private station could be compelled to supply.

The amendment was negatived.

Sir D. HOGG accepted an amendment authorising the Board to advance, free of interest, money to enable the authorised undertakers and owners to effect the necessary alterations. The amendment was agreed to, as was another, moved by Lt.-Col. MOORE-BRABAZON, to allow the Board and the authorised undertakers concerned to enter into an agreement to fix a sum of money to be taken in discharge of the liability of the Board.

Sir D. HOGG accepted an amendment, moved by Sir J. NALL, giving a right of appeal when authorised undertakers were dissatisfied with the award for expenses. This was agreed to.

Sir D. HOGG then moved an amendment, which, he said, would safeguard the position of the railway companies, so long as they did not come into the scheme. Under an earlier clause it might be suggested that there was power to alter the frequency of a railway company's supply or that of an authorised undertaker from whom a railway company was taking part of its supply. Under the Railways Act, 1921, provision had already been made for the Minister of Transport to make orders with regard to standardisation, including methods of electrical operation, type, frequency, and voltage, but Parliament then thought right that, before making an Order of that kind, the Minister should refer the Order to a committee, which should give interested parties an opportunity of being heard before it made its recommendations. It seemed not unreasonable in the circumstances that the position of the railways should be retained in this clause in the same way as it existed under the Act of 1921. He thought the clause also safeguarded the Board and the public. His amendment was to add the following new sub-section :—

" (4) Notwithstanding anything in this section—

(a) a railway company shall not be required to alter the frequency employed by it in its undertaking or generating station except by an Order made in accordance with the provisions of section 16 of the Railways Act, 1921;

(b) no authorised undertaker from whom any railway company derives a supply of electricity for the purposes of haulage or traction shall be required by the Board to alter the frequency of such supply delivered by it to a railway company unless and until an order as aforesaid has been previously made in respect of the railway company concerned."

In the course of further debate, Sir D. HOGG said that a provision was inserted in Clause 4 that a railway generating station operated by a railway company should not, without the consent of the owners, be included in a scheme as a " selected station," but that did not necessarily mean that it was a private generating station. Therefore, it might happen that a railway company might find itself getting an order for the standardisation of frequency. That was a position which the railway companies thought put them in some jeopardy. The Government thought it was not unreasonable to make it clear that, just as it was not taking the railway companies' stations, it was not proposing to alter their frequency in conditions under which it could not be done at present.

The amendment was carried by 23 votes to 6.

On the question that the clause, as amended, be agreed to, Sir J. NALL asked for some expression of opinion from the Government as to the desirability of continuing the standardisation proposals. Too far-reaching expenditure, he said, might involve the Central Board in insolvency.

Sir D. HOGG retorted that delay would cause increased expense, and would seriously damage the industry. The tactics pursued in some quarters in trying to prevent the passage of the Bill would react unfavourably on the electrical industry.

Mr. G. BALFOUR declared that to charge the frequency in a large, densely-populated area like Birmingham was not a commercial proposition. He, and his friends, had been accused of delaying progress, but their efforts had been only genuine endeavours to make the Bill a right and sound measure.

Major ATTLEE said that the Committee was flooded out with the constant repetitions of Mr. Balfour and his friends. The same points were put until half the Committee fell asleep and the other half was bored stiff!

Clause 9, as amended, was agreed to, and the Committee adjourned.

(To be continued.)

The National Physical Laboratory.

Annual Inspection by the General Board.

THE annual inspection of the National Physical Laboratory at Teddington by the General Board took place on June 22nd, a large number of visitors being received by Sir Ernest Rutherford, O.M. (president of the Royal Society and chairman of the Board), and Sir Joseph E. Petavel, K.B.E., D.Sc., F.R.S. (director of the Laboratory). The well-kept gardens of Bushy House were thrown open to visitors during the afternoon and tea was served in the main aerodynamics building. The exhibits, apparatus, and experiments which had been arranged for the visitors' inspection and instruction numbered nearly 200, too numerous to be noticed individually, but selected items are referred to below, whilst an idea of the activities of the N.P.L. during the past year may be gained by reference to the abstract of the annual report which was published in our issue of May 28th, 1926.

Lighting and Photometry.

One of the most striking demonstrations was witnessed in the Photometry Division, being an experiment on the imitation of daylight by means of artificial electric light. A window in a room in North Lodge has been entirely covered with translucent paper and on the outside of it is a whitened box which contains a familiar blue-bulb lamp. The effect inside the room is exactly similar to that produced by ordinary daylight passing through a window glazed with ground or opal glass, and the effect is singularly restful and pleasing to work in. The observers working in this room during the short days of winter were very deceived, we were told; so much so, in fact, that they expressed surprise on coming out of the room in the early evening from what appeared to them to be daylight into darkness. An integrating sphere photometer of an internal diameter of 10 ft. has been constructed for measuring the efficiency of fittings for interior lighting, street illumination, and similar purposes. It is believed to be the largest sphere in the world to be used for this purpose.

Aerodynamics.

In the Aerodynamics Department apparatus for determining the heat dissipation from an aeroplane wing was seen. As heat is given off at different rates at different positions upon a wing, a knowledge of the rates of heat loss from different parts of the wing is of the greatest importance in the design of wing radiators, enabling the use of a lighter radiator in the most efficient position. Radiators in the wings of the machine have been adopted to improve the stream-line shape of the aeroplane, and so avoid head resistance. Investigations of metals in all their aspects are carried out in the Metallurgy Department. X-rays are used to determine the way the atoms are arranged in the crystals and to the light alloys that are required for aircraft, in which aluminium and magnesium play the principal parts, we may shortly have to add the very light and strong metal beryllium, which has recently been successfully produced by the National Physical Laboratory in reasonable quantities. It is a very light, white, metal which retains its polish for many months; it is nearly as hard as iron, and although it is somewhat rare, larger supplies are likely to be found if serious search is made.

Sound Waves.

In the Physics Department sound-wave photography is accomplished by the passage of an electric spark across a short gap so that a single spherical sound pulse is produced; by means of a second illuminating spark-gap activated after a suitable time interval the shadow of the pulse can be photographed. This method can be used for testing the acoustic properties of buildings by the use of sectional models. The ripple tank forms an alternative to this method for investigation in architectural acoustics, and can also be turned to account in the exhibition of reflection and refraction of sound waves. It has lately been applied to show how, owing to refraction, errors in direction-finding with wireless waves may arise at a coastal receiving station.

X-Ray Work.

X-ray work has been done on determining the best manner in which to set diamonds which are used as pivots in various scientific instruments. The direction of the cleavage planes of the diamond with reference to the bearing surface has been found to be of great importance. In the detection of internal defects in steel and other metals, some 2 or 3 inches thickness of steel can be examined under favourable conditions; over 200,000 volts are applied to the X-ray tube used in this apparatus. Other equipment inspected with interest was that used for testing the protective materials which are submitted to the Laboratory for test following the recommendation of the British X-ray and Radium Protection Committee, which is charged with safeguarding operators of X-ray installations in hospitals and elsewhere, and its recommendations have been adopted all over the world.

Electrical Investigations.

In the Electricity Department a large number of magnetic tests have been made on welded plate joints and a fair measure of agreement between magnetic and mechanical tests has been found, but a considerable number of anomalous results remain unaccounted for. Experiments have been made on the magnetic screening properties of Stalloy ring stampings; for the screening of highly sensitive moving magnet galvanometers, the use of screens built up of ring stampings is very convenient and a series of curves giving the screening ratio for 1, 2, 3, and 4 concentric screens (correctly proportioned) has been calculated, from which the best screen to meet certain limiting conditions can be designed. The calculations are based upon a permeability of 400, which is the average value in weak fields for Stalloy stampings, which can be obtained quickly in any size at reasonable cost, and unavoidable openings in the screen are easily provided by cutting away portions of the rings at the desired place.

A test was also undertaken of the current-carrying capacity of a direct current circuit breaker rated at 4,000 amperes; tests were carried out up to 10,000 amperes, temperature measurements of various parts being made by means of thermocouples. Important work has been done on the effect of short circuits on cut-outs and a series of fuses was tested at Willesden by the

courtesy of the London, Midland & Scottish Railway. It is hoped that this work will provide the several manufacturers for whom it was done with valuable information on the behaviour and design of these important details of electrical equipment. Research for Government departments was continued with the object of evolving a type of fuse that should be satisfactory for ratings above 600 amperes, and, as the result of a long series of practical experiments, certain modifications in the design of the fuse element were arrived at which promise that a larger-sized type can be evolved to give equally satisfactory service at 700 and 800 amperes.

The grouping of cables investigation to obtain reliable indications of the temperature rise under various conditions of grouping and intermittency, except for one or two confirmatory tests, is now completed, and it only remains to collate and review the results obtained in order to determine what generalisations can safely be drawn from them. The investigation into the durability of cable dielectrics under various conditions has been continued throughout the year and the results obtained have formed the basis of a specification for rubber-insulated cables under these conditions.

An investigation of a preliminary character on the properties of an electrical cement has been completed. The cement is of a nature that suggests its possible use for making joints between conductors in the cold: for example, between two metals, or for cementing copper pigtails into carbon brushes.

A paper-tearing machine was evolved in connection with the buried cables research, to assist in the determination of the safe temperature at which paper-insulated cables may be operated. It was found necessary to have some means of estimating quantatively any deterioration in the mechanical properties of paper as the result of exposure to heat. Ordinary bursting and tearing methods were not practicable on account of the smallness of the samples that had to be dealt with, as these had to be taken from a few inches of paper strip, the width of which is usually less than one inch. The method adopted was to measure the energy required to pull a wire loop of a defined size across a short length of the strip, and to express this energy as ergs per centimetre width of the paper torn through. The paper is held on each side of the section of the strip to be tested in a specially designed form of double clamp, with parallel jaws separated by a small interval within which the wire loop moves. The amount of energy required to tear through unit width is deduced from the retardation experienced by a falling pendulum which pulls the wire loop through the paper; the pendulum actuates a pointer which moves over a scale calibrated to show directly the energy used. The machine has been tested and compared with results obtained by the paper-bursting machine, on a large series of samples submitted by the British Electrical and Allied Industries Research Association.

The construction of the building for high-voltage work which was commenced in the autumn of 1924, is now practically completed. The main building is designed for a million volts, with a subsidiary laboratory adjoining, into which high-voltage conductors can be brought from the main building. An interesting detail is the large doorway which will enable a high-voltage conductor to be taken out of the building with a clearance of not less than 15 feet in any direction. It is hoped that the plant will be ready for operation early in 1927.

Radio Research.

An interesting exhibit in the Photometry Division was a couple of dozen wireless valves which are being tested for efficiency at different periods during a continuous run of 1,000 hours. It is the first test of this kind which has been made at the Laboratory and is being carried out for one of the largest makers of valves in this country. Of interest to broadcast listeners was the somewhat elaborate equipment in the Wireless Division for testing valve amplifiers and receivers; another set of apparatus was shown in use for testing low-frequency transformers for amplification and distortion. In addition to a number of standard types of receivers a very sensitive two-valve frame-coil set was shown, which has recently been used for the reception of signals from a small ship's transmitter at a distance of about 7,000 miles. The range of wave-lengths covered by the activities of the Division is very wide: On the one hand, some small valve sets were exhibited operating on a wave-length of less than two metres, while, close by, a direction-finder was in use on transmission from an American station on a wave-length of nearly 20,000 metres.

A considerable amount of research has been carried out on quartz piezo-electric resonators and oscillators, directed mainly towards the development of an equivalent electrical network to represent the quartz, and to the determination of the values of the constants of this network. The quartz resonator can be represented by a series combination of inductance, capacity and resistance, shunted by a condenser, which mesh is again in series with another condenser in those cases in which electrodes are used close up to, but not touching, the parallel surfaces of the quartz plate or bar that are normal to the electric axis and to the electric field. In a typical case the logarithmic decrement of a bar was found to have the extraordinarily small value of 9×10^{-6}. This, of course, determines almost entirely its extreme selectivity and constancy of frequency of response.

Regarding the determination of amplification ratio and phase displacement of output and input voltages, some null methods of measuring those constants of valves, inter-valve coupling circuits, and amplifying systems generally are on trial; the method is an alternating potentiometer arrangement whereby the output voltage to be measured is balanced by an alternating vector voltage obtained from a resistance and variable mutual inductance in series. The system as applied to an intervalve transformer is shown in fig. 1; the arrangement is typical of others which may include valves. T is the transformer whose primary impedance Z_p is very large compared with the resistance R, so that the potential difference e_1 may be assumed equal to that given by I_1R. The ratio e_2/e_1 is given by $S/R\cos\phi$, where ϕ is the phase angle given by $\tan^{-1}\phi = M\omega/S$. $M\omega$ is usually small compared with S, so that by making R equal to, say, 10 ohms, the amplification is read off directly on S. The tests made with the bridge show great promise that the method will be of value in many investigations.

With reference to the performance of radio and audio-frequency amplifiers, during the past year the whole of the original plant for measuring amplification in connection with investigations for the Radio Research Board has been completely rebuilt in new premises, and considerably improved to give greater accuracy and to perform a wider series of tests. The radio-oscillator has been completely screened, the output leads being run in a new form of metal-lined trunk which has been adopted to eliminate induction effects. A special screened room has been built adjoining the room containing the measuring gear; the construction comprises a complete cage of ¼-in. mesh galvanised-iron wire gauze, and a special door with copper contacts so that when closed, the room becomes effectively screened, the amplifier under test occupying the centre of the cage; its efficiency is greatest at high frequencies. The apparatus has been used to analyse the performance of several amplifiers employed in the Division for research purposes at high frequencies, and improvement in design has followed as a result of the figures obtained.

Besides the analysis of amplification, a preliminary investigation into the input impedance of an amplifier has been undertaken with the resonance method of measurement. It was found possible to explain the observed results theoretically by considering the amplifier as a capacity and resistance in series, acting as a shunt to the tuned circuit. The effect of the reaction coil was examined and a theory has been established which explains the observed behaviour with considerable accuracy.

As a result of the earlier work on distortion, it was soon realised that most of these problems require experimental verification of fundamental points in the theory of amplifier behaviour, and it was suggested that fundamental reasearch be contemplated with a view to establishing the properties of the simplest valve combinations. The difficulty has hitherto been one of delicate measurement. Accordingly a large model amplifier has been built; instead of dissipating 1/10th of a watt in the anode circuit, as in a small receiving valve, use will be made of small power valves capable of dissipating up to 100 watts. In the two-stage amplifier any form of coupling component can be inserted; the high-voltage supply consists of a 2,500-volt d.c. motor generator set which can give a maximum output of 1 kW. The input is measured electrostatically, and the output can be determined by bridge methods in those cases where the current wave form is approximately sinusoidal. Since this condition rarely occurs, however, the output is preferably determined by a wave form analyser, for which purpose a cathode ray oscillograph is conveniently used; on account of the utility of this instrument for many other measurements at radio and audio frequencies, a completely self-contained oscillograph is being constructed on a movable table, for use in the first instance in connection with the present work on amplifiers. In this equipment, a linear time-scale device is used which provides a means of applying to one

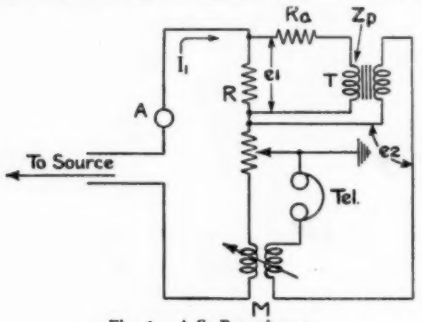


Fig. 1.—A.C. Potentiometer.

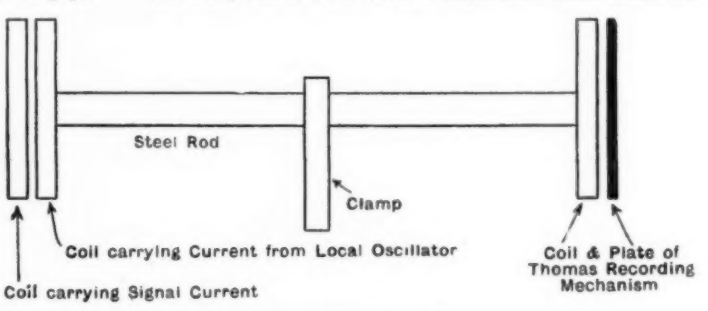

Steel Rod
Clamp
Coil carrying Current from Local Oscillator
Coil carrying Signal Current
Coil & Plate of Thomas Recording Mechanism

Fig. 2.—Signal Current Analyser.

pair of plates of the oscillograph tube a potential difference which varies uniformly with time, the scale being variable over a very wide range. The potential wave to be analysed is applied to the other pair of plates, and if the time-scale frequency be adjusted to be the same as the applied frequency, the oscillograph will trace out the wave form on a linear time scale. The wave can be observed or photographed directly, enlarged, and analysed into its constituent harmonics by a graphical application of Fourier's analysis. This equipment will be used in the forthcoming work on distortion, and will reveal the properties of the various methods of coupling employed in cascade valve amplifiers. Fundamental research on short waves is being undertaken and several interesting instruments have been devised.

Radio Interference.

In view of the inadequacy of the "equivalent decrement" as a measure of the interfering effect in radio transmission, a sub-committee of the Imperial Communications Committee's Sub-Committee on Technical Wireless Regulations is considering the whole subject. Since the practical aspect is the telephone signal-intensity produced outside the nominal carrier wave or signalling wave of the transmitter employed, the preliminary work has been concentrated on the problem of determining the variation of the telephone intensity of a given transmission with the natural frequency of the receiving circuit. Two methods are being developed: In the first, the decrease of signal intensity due to distuning the receiving circuit is balanced against a known increase of coupling of the receiving circuit to the detector-amplifier system. The second method consists of balancing the decrease of signal intensity due to distuning against a known increase of low-frequency amplification. In addition, spectrum analysis, depending on the exceedingly small decrement of the end vibrations of a steel rod, is also being investigated; the method is illustrated in fig. 2. A coil carrying the main current of the receiving (i_1) circuit is brought into proximity with a similar coil mounted on one end face of the rod, the latter coil carrying current (i_2) derived from a local oscillator of variable frequency. The force between the coils will be proportional to i_1, i_2 and will contain a component of frequency $w_1 \sim w_2/2\pi$, which can be adjusted to exact resonance with that of the steel rod. The other end of the steel rod can carry recording mechanism. It is hoped in this way to analyse the spectrum of the signal with what is virtually a line resonant system.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

New Igranic Coils.

It is surprising how few amateurs possess the means for tuning down below the usual broadcast wavelengths, for it is fairly safe to say that quite a number of receivers now in use for broadcast reception only could be used for the reception of wavelengths below 100 metres if suitable short-wave

Fig. 1.—Igranic Short-wave Coil.

Fig. 2.—"Triple Honeycomb" Coil.

coils were used. The IGRANIC ELECTRIC CO. feels that there is a demand for coils suitable for a wavelength range of approximately 10 to 100 metres, and has produced a set of four coils for this wavelength range. They are wound with heavy-gauge bare wire, supported in such a manner as to preserve the accuracy of spacing with a minimum of supporting material, which is arranged to keep losses and self-capacity at a minimum (fig. 1). Standard plug mounting is used, so that the general design of the short-wave receiver need not cause the constructor any difficulty; the coils are made with 2, 4, 6, and 9 turns.

Of all the plug-in types of coil on the market, the Igranic "honeycomb" has enjoyed deserved popularity. The new Igranic "triple honeycomb" coils, one of which is shown in fig. 2, do not at first sight appear to differ very much from the old type, except that each coil is divided into three sections, wound side by side and joined in series, which apparently small alteration has a very marked effect upon the characteristics of the whole coil. The distributed capacity is very much less, in some cases being less than one quarter the previous figure; the h.f. resistance is reduced also, and the accuracy of spacing between the three sections is maintained by the machines on which the coils are wound. The coils cover a much wider wavelength range than the original type, so that fewer coils are required to cover the complete tuning range obtainable with a set of coils, namely, 100 to 25,000 metres; also, as the coils have a better wavelength overlap, smaller condensers can be used for tuning, if desired.

The "Pendleton" Accumulator Charger.

The aim of Messrs. WARD & GOLDSTONE, LTD., in placing the rectifier illustrated in fig. 3 (without its cover) on the market is to provide an inexpensive method of charging accumulators from a.c. supply mains, particularly for owners of radio receiving sets who desire the convenience and

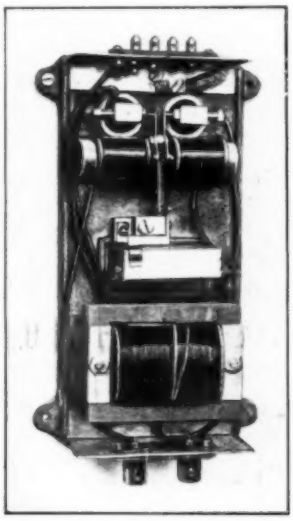


Fig. 3.—The "Pendleton" Accumulator Charger.

Fig. 4.—New "Ediswan GP4" Valve.

economy of carrying out the operation at home. On a 220-volt circuit the current consumption of the device is said to be between 25 and 29 watts, so that from 35 to 40 hours of charging should be obtainable at the cost of 1 kWh. It is arranged to charge a 6-, 4-, or 2-volt accumulator, the normal charging rate being about 2 amps., and features of the set are the facts that no expensive replacements are required, full-wave rectification is obtained, and the appliance operates silently, while it is claimed that it will run in step with the supply with a voltage variation of 10 per cent. from normal and a frequency variation of 5 per cent. up or down. The Company is also marketing high-pressure battery eliminators, which can be connected to any convenient lamp socket or wall plug, and a switch is fitted to enable the circuit to be broken when the receiver is not in use. The a.c. model is provided with dual tapping (8 in all), giving 30, 60, 90, and 130 volts, while the d.c. type gives five voltages.

New "Ediswan" Products.

Two new valves which are being introduced to the public by the Edison Swan Electric Co., Ltd., samples of which have reached us, are to be known as the "GP4" and "PV4," one of which is shown in fig. 4. Both of the dull-emitter pipless type with a 4-pin cap made of moulded insulating material, the former's specification is: filament current, 0.15 A at between 3.5 and 4 V; plate voltage, from 60 to 120; impedance, 22,000 ohms; normal working slope, 0.55 mA/V; with an amplification factor of 12. A companion to this general purpose valve is the PV4 power valve, which differs in that its filament current is 0.35 A, its impedance is 9,500 ohms, amplification factor 6, and slope 0.65 mA/V. Negative grid bias (from 2 to 10 volts) should increase as the anode voltage is raised. The bulbs are almost completely "silvered," but a clear glass "window" at the top enables the electrodes to be watched during operation, whilst a wafer disk floats inside the bulb. As a safeguard a glass tube is lead-sealed over one filament pin to ensure that the valve has not been used.

We have also had samples of the Ediswan accumulators, known as "Hymeg," for high-pressure purposes and grid bias. The former is a 30-cell, 60-volt battery with a capacity of 2 amps. at the 10-hour rate and when used for supplying high-

pressure to a 3- or 4-valve set its capacity should be from 3,000 to 4,000 milliamperes. The bias battery's six cells give 12 volts and high insulation is ensured between cells by means of horizontal and vertical ribs moulded on the sides of the glass boxes; inspection is arranged for through the glass lids, and facilities for tapping by means of wander plugs is made every 2 volts. The use of separators has been eliminated by moulding internal ribs on the inside of the cells, which separate the plates and obviate the possibility of injurious foreign matter being introduced into the cells from this source. The cells have been specially designed, it is claimed, to stand on open circuit for exceptionally long periods without sulphation and are, therefore, also suitable for use with valve sets requiring only a few milliamps plate current, of such order that a period of, say, from four to six months is taken to discharge the cells. The normal charge rate of the cells is 0.25 amp. and the batteries are supplied in anti-sulphuric black-enamelled hard-wood crates with leather carrying handles, complete with wander plugs and a filler with each for use when filling with acid and consequent topping up when necessary.

Australian Imports and Exports.

THE following figures showing the values of the imports of electrical goods into Australia in the fiscal year 1924-25 have been taken from the recently-issued official trade returns. The corresponding figures for the previous twelve months have been added for purposes of comparison and notes of increases or decreases given. We refer briefly to the electrical exports at the end of this article.

	1923-24. £	1924-25. £	Inc. or dec. £
Cable and wire, covered with cotton—			
Total	15,000	24,000	+ 9,000
From United Kingdom ...	14,500	22,000	+ 7,500
,, Holland	—	1,000	+ 1,000
Telegraph and telephone cable, paper-insulated, lead-covered—			
Total, mainly from United Kingdom	263,000	179,000	- 84,000
Other telegraph and telephone cable—			
Total	996,000	1,125,000	+129,000
From United Kingdom ...	962,000	1,080,000	+118,000
,, Netherlands ...	9,000	16,000	+ 7,000
,, United States ...	22,000	27,000	+ 5,000
Carbon manufactures—			
Total	24,000	25,000	+ 1,000
From United Kingdom ...	12,000	12,000	—
,, United States ...	9,000	8,000	- 1,000
Dynamo-electric machines—			
Total	990,000	1,038,000	+ 48,000
From United Kingdom ...	613,000	791,000	+178,000
,, Canada	7,000	7,000	—
,, Germany	31,000	14,000	- 17,000
,, Holland	7,000	11,000	+ 4,000
,, Sweden	31,000	12,000	- 19,000
,, United States ...	271,000	178,000	- 93,000
,, Switzerland ...	10,000	13,000	+ 3,000
Fans, electric—			
Total	41,000	35,000	- 6,000
From United Kingdom ...	15,000	11,000	- 4,000
,, Italy	8,500	11,000	+ 2,500
,, United States ...	15,000	11,000	- 4,000
Switches, fuses and lightning arresters—			
Total	253,000	345,000	+ 92,000
From United Kingdom ...	114,000	213,000	+ 99,000
,, Japan	3,000	2,000	- 1,000
,, United States ...	132,000	121,000	- 11,000
,, Germany	600	3,600	+ 3,000
Heating and cooking appliances—			
Total	42,000	39,000	- 3,000
From United Kingdom ...	11,000	12,000	+ 1,000
,, Canada	5,000	3,600	- 1,400
Lamps, filament—			
Total	348,000	409,000	+ 61,000
From United Kingdom ...	165,000	191,000	+ 26,000
,, Hungary	2,000	5,000	+ 3,000
,, Holland	128,000	155,000	+ 27,000
,, United States ...	44,000	39,000	- 5,000
Measuring and recording instruments—			
Total	230,000	201,000	- 29,000
From United Kingdom ...	146,000	102,000	- 44,000
,, Switzerland ...	46,000	36,000	- 10,000
,, United States ...	30,000	55,000	+ 25,000
Regulating and controlling apparatus—			
Total	219,000	283,000	+ 64,000
From United Kingdom ...	81,000	158,000	+ 77,000
,, United States ...	128,000	108,000	- 20,000
,, Switzerland ...	—	8,000	+ 8,000
Static transformers and induction coils—			
Total	124,000	259,000	+135,000
From United Kingdom ...	83,000	178,000	+ 95,000
,, Sweden	5,000	600	- 4,400
,, United States ...	32,000	75,000	+ 43,000
Telegraph instruments and appliances—			
Total	28,000	54,000	+ 26,000
From United Kingdom ...	19,000	32,000	+ 13,000
,, United States ...	6,000	22,000	+ 16,000
Telephones—			
Total	237,000	409,000	+172,000
From United Kingdom ...	107,000	265,000	+158,000
,, Canada	4,000	—	- 4,000
,, Sweden	6,000	2,000	- 4,000
,, United States ...	115,000	117,000	+ 2,000
,, Czecho-Slovakia ...	—	4,000	+ 4,000
,, France	—	10,000	+ 10,000
,, Germany	600	4,000	+ 3,400
Telephone switchboards and appliances—			
Total	325,000	554,000	+229,000
From United Kingdom ...	170,000	360,000	+190,000
,, Belgium	7,700	12,000	+ 4,300
,, Sweden	12,000	10,000	- 2,000
,, United States ...	134,000	168,000	+ 34,000
Vacuum tubes—			
Total	33,000	150,000	+117,000
From United Kingdom ...	15,000	60,000	+ 45,000
,, Holland	3,000	32,000	+ 29,000
,, United States ...	12,000	56,000	+ 44,000
Electrical appliances, n.e.i.—			
Total	695,000	1,152,000	+457,000
From United Kingdom ...	333,000	675,000	+342,000
,, Canada	9,000	11,000	+ 2,000
,, Denmark	6,000	17,000	+ 11,000
,, Germany	6,500	19,000	+ 12,500
,, Japan	16,000	8,000	- 8,000
,, United States ...	312,000	399,000	+ 87,000
,, Switzerland ...	4,000	9,000	+ 5,000

Exports.

Australia carries on a small export trade in electrical goods of her own manufacture. Below are given the comparative values in 1923-24 and 1924-25.

	1923-24. £	1924-25. £	Inc. or dec. £
Electrical materials, other than machinery and appliances—			
Total	22,000	26,000	+ 4,000
To New Zealand	20,000	18,000	- 2,000
Electrical machinery and appliances—			
Total	15,500	38,000	+ 22,500
To New Zealand	11,000	35,000	+ 24,000
,, Fiji	1,000	500	- 500
,, New Guinea	800	—	- 800

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

"Electrical Review" Trade Names Supplement.

Being responsible for a fairly large factory installation situated in the country, I can assure you from experience that the above fulfils a long-felt want in my case.

It will prove a real time and trouble saver, and I feel sure that many others similarly placed will also appreciate this new supplement.

J. McDermott
(*Manager, Power Plant Department,* JOHN DICKINSON & CO., LTD.)

Hemel Hempstead, *June 25th*, 1926.

Electrical Engineers' Salaries.

Seeing in your "Correspondence" columns in last week's issue of the ELECTRICAL REVIEW, a letter on the subject of the salaries at which posts are now offered to those in the electrical engineering profession, I am prompted to remark that it is certainly time something was done to improve the remunera-

tion now usually offered to persons so engaged, except the few in favoured places; which remuneration is in many cases, I consider, really disgracefully poor.

I have myself experience that many of the posts advertised in your columns are valued at between £3 and £4 per week (I was recently offered £2 15s. by a well-known firm of electrical manufacturers!) and as such do not offer any great attraction to those hoping to improve their station in life.

There is no doubt that technical training in these days, as an investment both of time and money, is a sheer loss, producing no return whatever; and we should all do our utmost to dissuade friends of ours or their sons from entering the engineering profession unless they do it entirely on a philanthropic basis, expecting no reward for their labours; for to lead them to suppose that they are going into a profitable career would certainly be to render them a disservice.

Engineering is indeed a "noble profession"; for a profession that works for the good of the community alone, and not for itself, seldom obtains just reward for its labours.

For myself, at the risk of being accused of selfish motives, I will declare that I made the greatest mistake of my life in electing to go in for engineering. I may say that after a sound technical training (Finsbury Technical College, two years' student at Day Courses, certificated), Army engineering experience, shops' training and commercial practice, my income is £3 per week at 30 years of age.

A.M.I.E.E.

June 23rd, 1926.

The Lee Network Box.

The new design of underground network box invented by Mr. L. R. Lee is very interesting. It would, however, be more interesting if Mr. Lee would submit a sketch to you for publication showing how the cables would be sealed (say three-core and triple concentric), and above all, showing the actual drawings of cable connections to the fuse contacts.

The weak point of this box is, in my opinion, the method of cable connection. In a multiway pillar one has to lift up on the cover not only the panel, but also heavy tails which must describe an arc at the end of the fuse.

A. J. Abraham.

Electricity and Tramways Department,
Bexley Heath, *June 25th*, 1926.

[A copy of this letter was forwarded to Mr. Lee, whose reply is given below.—EDS. ELEC. REV.]

With regard to the suggested sketch showing how the cables would be sealed and the connections made to the fuse contacts, it is the intention to make a drawing covering these points and to submit it for publication as soon as ready.

With regard to the weight of tail cable to be lifted, it should of course be borne in mind that all the work is done by means of levers—in the examples shown the levers are screws—and the leverage can be altered in length within reason. For instance, in the swinging panel design the length of the cover can be increased as much as one desires, and with the screws, the pitch of the thread can be adjusted to suit; but it is considered that in comparison with the ordinary network box, as I made an attempt to point out in the description, the lifting is more favourable to the new design. It is true that up to the moment none of the new boxes have been made, but it is confidently expected that one man will at any time be able to open out the new box, whereas it frequently takes three or four men to take the outer and inner covers off an ordinary network box—due, as pointed out, to the oxidisation of the cover jointing material.

Then again, as to the actual weight of tail flexible to be lifted, this is greater in the central screw design, and taking the worst case—that of a 4-core a.c. feeder box with four outgoing distributors—and assuming that the feeder is of 0.5 sq. in. section and the distributors each 0.12 sq. in., then there would be something like 20 feet total length to be lifted or an actual weight of, say, 24 lb.

Only half the total weight length of the cable is lifted, as the tails should be fixed to a cleat at a point opposite the horizontal centre line of the full lift.

In the case of the swinging-panel design, the weight of the cable lifted under each cover would be only one quarter, about 6 lb. It would therefore appear that the weight of the cable need not be considered as seriously affecting the design adversely.

L. R. Lee.
Mains Engineer.

Electricity Department,
Manchester, *June 28th*, 1926.

Electricity in Farmhouses.

In the discussion on Mr. S. E. Britton's paper read at the I.M.E.A. Conference in Glasgow, you report me on page 974 of your issue of the 25th instant as stating that a low voltage in farmhouses and similar places could be dealt with by "bare" wires cleated up anyhow.

What I really said was "bell" wires, and I shall be much obliged if you will correct what I think is an obvious error, in your next issue.

R. A. Chattock,
City Electrical Engineer.

Birmingham, *June 28th*, 1926.

Parliamentary News.

(From Our Parliamentary Reporters.)

Smoke Abatement.—On June 22nd, Mr. CHAMBERLAIN, Minister of Health, in moving the second reading of the Public Health (Smoke Abatement) Bill, which seeks to prevent atmospheric pollution, said that dwelling-houses did not come under the scope of the Bill. The solution of the smoke problem so far as those dwelling-houses were concerned was to make it as cheap and easy as possible for people to use electricity and gas, and to accelerate the production of smokeless fuel. The Bill was read a second time.

Communication with Ships.—On June 22nd, Sir W. MITCHELL-THOMSON, Postmaster-General, informed Mr. Day that the total number of messages sent between Post Office wireless stations and ships during the year ended March 31st, 1926, was about 223,600, and the number sent from Post Office wireless stations to foreign countries was about 228,000.

Engineering Workers Unemployed.—On June 23rd, Sir A. STEEL-MAITLAND, Minister of Labour, informed Mr. Day that the following table showed the numbers and percentage of insured workpeople recorded as unemployed for the engineering and shipbuilding trades in Great Britain and Northern Ireland in May, 1926 and 1925 respectively:—

Industry.	Number unemployed. May 24th, 1926.	Number unemployed. May 25th, 1925.	Percentage unemployed. May 24th, 1926.	Percentage unemployed. May 25th, 1925.
General engineering, engineers' iron and steel founding ...	107,839	77,118	17.2	12.3
Electrical engineering	8,136	4,072	10.6	5.7
Marine engineering, &c.	15,993	12,293	25.9	18.6
Constructional engineering	5,603	3,262	21.4	13.6
Construction and repair of motor vehicles, cycles and aircraft	21,478	11,929	10.0	5.9
Shipbuilding and ship repairing ...	92,695	80,424	38.3	31.5

Private Bills.—The London Electric and Metropolitan District Railway Companies' Bill has been read a first time in the House of Lords and referred to the examiners of private Bills. The Shropshire, Worcestershire and Staffordshire Electric Power Bill, and the Mexborough and Swinton Tramways Bill have been read the third time in the House of Lords and passed.

Special Orders. — The House of Lords has approved Special Orders relating to Inverness, Dumbartonshire, Llantrisant, Bedford (Extension), East Anglia, Petersfield and District, and Wrexham Rural District.

Oil from Coal.—On June 22nd, the DUCHESS OF ATHOLL informed Col. Applin that experiments in the extraction of oil from coal by carbonisation methods were being actively pursued in this country, both at the Fuel Research Station and by a number of firms and individuals. Extensive experiments on the production of oil by the so-called Bergin method of hydrogenating coal were being carried on in Germany. A number of British firms were represented in these experiments and by agreement the Department of Scientific and Industrial Research obtained full information as to results and a voice in determining the course the experiments were to take. Experiments on this and other processes were also being carried out in this country. It was too early to make any statement as to results.

Low Temperature Carbonisation.—On June 24th, Mr. WATSON asked whether the low-temperature carbonisation of coal was to form part of the Government scheme for the reorganisation of the coal trade; if so, whether it was intended to proceed by administrative action; and whether it would take the form of assisting private enterprise or by the Government's establishing carbonisation plant in various parts of the coalfields.

Lord E. PERCY said that in the opinion of the Department of Scientific and Industrial Research it was doubtful whether any of the existing schemes for low-temperature carbonisation, though they contained many elements of promise, had as yet got beyond the experimental stage. Low-temperature carbonisation could not, therefore, as yet form part of any scheme for the reorganisation of the coal trade. As soon as any process or processes of low-temperature carbonisation were shown to be commercially practicable it could not be doubted that private enterprise would rapidly develop them. In the meanwhile, the Department of Scientific and Industrial Research was carrying on its own investigations at the Fuel Research Station, and was giving its assistance in testing results which were obtained elsewhere.

Fuel Research Department.—On June 24th, Lord E. PERCY informed Mr. Lawson that in 1924 the Government authorised the Department of Scientific and Industrial Research to increase the annual expenditure on fuel research by a sum then estimated for 1925 at about £25,000 and for subsequent years at £35,000. The actual expenditure of the Department on Fuel Research was £48,145 in 1924 and £76,241 in 1925, an increase of £28,000. The expenditure for 1926 was estimated at from £92,000 to £102,000, a total increase of £45,000 or more over the 1924 expenditure.

Published Specifications.

Compiled expressly for this journal by Patent Agents.

The name of the applicant's patent agent, if any, will be found on the printed specification.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

28,847. "Earthing of electrical apparatus." Switchgear & Cowans, Ltd., and G. H. Neep. December 2nd, 1924. (252,750.)

28,971. "Radio-telegraphic direction-finding and other purposes." R. A. W. Watt. December 3rd, 1924. (252,263.)

29,370. "Duplex telegraphy." E. S. Heurtley and Muirhead & Co., Ltd. December 8th, 1924. (252,752.)

1925.

2,396. "Electrical signalling and control systems." Metropolitan-Vickers Electrical Co., Ltd. February 1st, 1924. (228,542.)

2,436. "Balanced electrical system of winding." Soc. d'Etudes pour Liaisons Téléphoniques et Télégraphiques a Longue Distance. August 27th, 1924. (239,159.)

2,761. "High resistances, more particularly for use in radio communication." Lissen, Ltd., and R. P. Richardson. January 30th, 1925. (Cognate application No. 30,132/25.) (252,759.)

3,630. "Electrically-heated vessels or containers." S. G. Burdick. November 9th, 1925. (252,425.)

4,752. "Telephonic receivers." E. A. Graham. February 20th, 1925. (253,430.)

4,961. "Secret combination automobile switches." H. C. Osborne and W. E. Gammon. February 23rd, 1925. (252,437.)

4,963. "Wireless transmitting and receiving apparatus." G. W. Hale and Radio Engineering Co., Ltd. February 23rd, 1925. (Cognate application 31,890/25.) (252,764.)

5,034. "Electric switches." J. A. Crabtree. February 24th, 1925. (252,441.)

5,090. "Automatic and semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). February 24th, 1925. (252,444.)

5,121. "Clutch mechanism specially suitable for use in telegraphic tape-punching, transmitting, receiving and printing apparatus." Creed & Co., Ltd., and F. G. Creed. February 24th, 1925. (252,446.)

5,275. "Electrical arc-lamps for medical or therapeutical purposes and the like." F. V. Welch. February 26th, 1925. (252,451.)

5,331. "Automatic or semi-automatic telephone systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (G. Deakin.) February 26th, 1925. (252,452.)

5,333. "Automatic or semi-automatic telephone systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.), L. P. Lowry, and J. R. Gould. February 26th, 1925. (252,453.)

5,489. "Electric welding machines." R. Mack. February 28th, 1924. (230,093.)

5,533. "Wireless receivers." R. G. Taylor and J. Rowbotham. February 28th, 1925. (252,767.)

5,642. "Electrodes for alkaline accumulators." Batteries, Ltd., and A. Levin. March 2nd, 1925. (252,467.)

5,666. "Electrical resistances." A. Reyrolle & Co., Ltd., and H. W. Clothier. March 2nd, 1925. (252,770.)

5,681. "Electric burglar alarms." H. Eisler, H. J. Tibbles, and Rely-A-Bell Burglar & Fire Alarm Co., Ltd. March 2nd, 1925. (252,771.)

5,781. "Means for adjusting electric condensers or the like." J. W. Jemmison. March 3rd, 1925. (252,469.)

5,795. "Electric indicating devices." Anschutz & Co. March 3rd, 1924. (230,111.)

5,842. "Method of and apparatus for amplifying electric signal impulses." M. I. Pupin and H. G. Herbig. April 11th, 1924. (232,183.)

5,868. "Manufacture of thin foils, more particularly for telephone and microphone diaphragms." Dr. C. Muller. March 4th, 1924. (230,456.)

5,946. "Apparatus capable of being operated electrically from a distance and suitable for registering and indicating numerical data and the like." E. A. Graham and A. C. Brockies. March 4th, 1925. (252,783.)

5,972. "Electric discharge tubes with rarefied atmospheres." J. B. J. M. Abadie and N. M. Courtines. March 4th, 1924. (230,467.)

6,061. "Electrical frequency-changing apparatus of the thermionic type." H. Andrewes and Dubilier Condenser Co., Ltd. (in voluntary liquidation). March 5th, 1925. (252,789.)

6,128. "Electrical variable-speed systems." D. Maclaurin. January 6th, 1926. (252,793.)

6,152. "Apparatus for testing crystal detectors for wireless telegraphy and telephony." F. H. Middleton. March 6th, 1925. (252,794.)

6,179. "Means for controlling the speeds of a number of electric motors." F. G. Warburton. March 6th, 1925. (252,795.)

6,190. "Apparatus for transmitting and receiving signals." G. M. Wright and S. B. Smith. March 6th, 1925. (252,797.)

6,191. "Radio transmission and reception of pictures." G. M. Wright and S. B. Smith. March 6th, 1925. (252,798.)

6,192. "Reception of pictures in copying-telegraphy and television." G. M. Wright and R. N. Vyvyan. March 6th, 1925. (252,799.)

6,308. "Wireless and wired-wireless systems." F. W. Le Tall (Westinghouse Electric & Manufacturing Co.). March 7th, 1925. (252,804.)

6,310. "Electromagnetic clutches, brakes, and the like." C. Q. Payne. March 7th, 1924. (230,488.)

6,379. "Electric discharge vessels, tubes, or the like." Dr. E. F. Huth Ges. fur Funkentelegraphie. March 8th, 1924. (230,492.)

6,451. "Relays and like devices." British Thomson-Houston Co., Ltd., and H. S. Petch. March 9th, 1925. (252,807.)

6,481. "Devices for intensifying the spark and indicating the functioning of sparking-plugs and magnetos for internal-combustion engines." J. A. Brook. March 10th, 1925. (252,808.)

6,540. "Protective device for high-tension networks provided with earthing coils." Akt. Ges. Brown, Boveri et Cie. March 10th, 1924. (230,503.)

6,554. "Electrical protective arrangements for alternating-current systems." A. J. King and Metropolitan-Vickers Electrical Co., Ltd. March 10th, 1925. (252,810.)

7,043. "Variable electric condensers or inductances." W. Noble and F. Clark. March 16th, 1925. (252,829.)

7,264. "Telephone lines or cables." Siemens & Halske Akt. Ges. December 9th, 1924. (Addition to 230,495.) (244,396.)

7,895. "Electric arc-lamps." E. Steinberg. March 24th, 1925. (252,495.)

7,910. "Electrical resistances." S. C. Lloyd, P. L. Harlow, and Metropolitan-Vickers Electrical Co., Ltd. March 24th, 1925. (252,496.)

8,240. "Time-limit relay devices." Siemens Bros. & Co., Ltd., E. A. Petithory, and E. R. Garrod. March 27th, 1925. (252,834.)

8,534. "Coil-stands for use in connection with wireless apparatus or the like." A. W. Lotinga. March 31st, 1925. (252,501.)

8,593. "Electric indicating means, particularly adapted to indicating systems for motor vehicles." A. J. H. Haddan (Auto Meter Co., Inc.). March 31st, 1925. (252,837.)

8,866. "Coil-holders for wireless receiving and transmitting apparatus." H. A. Yoward. April 3rd, 1925. (252,504.)

9,038. "Coil-holders used in wireless telegraph and telephone apparatus." N. G. Johnson. April 4th, 1925. (252,506.)

9,726. "Accumulator batteries." W. Haddon. April 14th, 1925. (252,844.)

9,834. "Thermionic indicating means responsive to light variations." J. J. Dowling. April 15th, 1925. (Addition to 237,952.) (252,512.)

10,015. "Pivotally-mounted lamps and switches therefor." S. Heath and Sons, Ltd., A. Tongue, and A. E. Mason. April 17th, 1925. (252,513.)

10,157. "Electromagnetically-controlled circuit-breakers." M. J. Railing and A. E. Angold. April 18th, 1925. (252,514.)

10,529. "Electric cables." British Insulated Cables, Ltd. (formerly British Insulated & Helsby Cables, Ltd.) and G. H. Nisbett. April 23rd, 1925. (252,519.)

11,366. "Flame-proof insulating material." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). May 1st, 1925. (252,856.)

11,968. "Coil-holders for wireless receiving sets." A. F. Godden and P. T. Bradley. May 8th, 1925. (252,531.)

12,529. "Electrical locking apparatus for doors or the like." E. Jones. May 14th, 1925. (252,872.)

12,834. "Electric switches." A. P. Lundberg, G. C. Lundberg, P. A. Lundberg, and G. Pegg. May 16th, 1925. (Cognate application 28,617/25.) (252,536.)

12,837. "Electric relays and magnetic-microphonic amplifiers." J. T. McDermott. May 16th, 1925. (252,874.)

12,948. "Electric resistance elements." British Thomson-Houston Co., Ltd., H. W. H. Warren, and R. Newbound. May 18th, 1925. (252,537.)

13,064. "Production of X-rays." J. G. Casas. May 19th, 1925. (252,879.)

13,206. "Dynamo-electric machines." International General Electric Co., Inc. May 20th, 1924. (234,490.)

13,239. "Reflectors or shades for lighting purposes." Benjamin Electric, Ltd., and H. T. Harrison. May 20th, 1925. (252,880.)

15,224. "Rheostats." Benjamin Electric, Ltd. January 26th, 1925. (246,435.)

15,469. "Electric arc-lamp, particularly applicable for medical treatment." J. Bell & Croyden, Ltd., and J. W. Mason. June 15th, 1925. (252,907.)

15,807. "Shunt-excited rotary converters." R. Meller. June 23rd, 1924. (235,901.)

15,821. "Electric motors." H. Wade (H. K. Sandell). June 18th, 1925. (252,553.)

15,841. "Vacuum tube electric devices." Dubilier Condenser Co. (1925), Ltd. (J. V. Capicotto). June 19th, 1925. (252,544.)

16,234. "Illuminating appliances." P. W. Berry. June 23rd, 1925. (252,558.)

16,716. "Circuit-breakers." G. S. Fischer. April 18th, 1925. (250,891.)

16,809. "Insulators for high-tension electric conductors." A. Simon. June 30th, 1925. (252,561.)

17,367. "Electrical installations comprising voltage-changing devices." M. Doloukhanoff. July 7th, 1924. (236,596.)

18,790. "Receiving apparatus for radio-telegraphy and telephony." Compagnie pour la Fabrication des Compteurs et Materiel d'Usines à Gaz. May 22nd, 1925. (252,309.)

19,263. "Automatic telephone exchange system." B. Brander. July 29th, 1925. (252,934.)

19,440. "Valves for wireless telegraphy and telephony." J. A. M. Hawadler and Soc. Française de Lampes à Incandescence Luxor. August 2nd, 1924. (237,919.)

20,311. "Variable resistance unit." W. M. Scott. February 24th, 1925. (248,317.)

20,900. "Electric condensers." F. H. Rogers (A. H. Carlisle and A. Emerson). August 20th, 1925. (252,941.)

21,616. "Electric furnaces." Siemens & Halske Akt. Ges. September 2nd, 1924. (239,510.)

21,795. "Frequency-changers for electric currents." Telefunken Ges. fur Drahtlose Telegraphie. August 30th, 1924. (239,242.)

21,870. "Electric fuses or like automatic cut-outs." "Elfa" Elektrotechnische Fabrik Ges. September 1st, 1924. (239,244.)

23,137. "Process and apparatus for the manufacture of earth metals by electrolysis." H. Dolter. September 17th, 1924. (240,163.)

23,209. "Electrical resistance devices and method of making same." Dubilier Condenser Co. (1925), Ltd. September 18th, 1924. (240,171.)

23,749. "Method of converting electrical into acoustic energy without inertia." Dr. H. Konemann. September 23rd, 1925. (Convention date not granted.) (241,874.)

24,418. "Means for varying the wave lengths of valve transmitters for wireless or the like signalling." Telefunken Ges. fur Drahtlose Telegraphie. October 1st, 1924. (240,847.)

24,728. "Gearing for operating wireless instruments." J. G. Newey and C. R. Jerred. October 5th, 1925. (252,961.)

24,879. "Signalling or alarm devices operable in response to faults in an electric distribution system." International General Electric Co., Inc. October 6th, 1924. (240,878.)

26,071. "Electric heater for curling-tongs." P. Markoff. October 19th, 1925. (252,605.)

26,077. "Electric furnaces." British Thomson-Houston Co., Ltd. October 23rd, 1924. (241,897.)

26,540. "Apparatus for heating liquids by electricity." H. Wilson & Co., Ltd., and D. S. Maclachlan. October 23rd, 1925. (252,607.)

26,668. "Thermionic valves." Dubilier Condenser Co. (1925), Ltd. October 24th, 1924. (241,943.)

27,288. "Illuminated signs." Patent-Treuhand Ges. fur Elektrische Gluhlampen. February 17th, 1925. (247,914.)

27,489. "Alternating-current distribution systems." British Thomson-Houston Co., Ltd. November 4th, 1924. (242,640.)

28,008. "Electric radiators or heaters." G. Hanchett and C. H. Barratt. November 7th, 1925. (252,983.)

28,138. "Rotors of dynamo-electric machines." Thyssen & Co. Akt. Ges. and Dr. F. Laszlo. November 9th, 1925. (252,985.)

28,608. "Mounting and driving of electric generators on internal-combustion engines." Alvis Car & Engineering Co., Ltd., and G. T. Smith-Clarke. November 13th, 1925. (252,622.)

28,628. "Method of and means for connecting electrical conductors." J. Burk. November 13th, 1925. (252,623.)

28,719. "Wheatstone bridges for the measurement of electrical capacity." A. Campbell. November 14th, 1925. (Addition to 244,596.) (252,990.)

28,739. "Radio and the like receivers operating on the heterodyne principle." Telefunken Ges. fur Drahtlose Telegraphie. November 15th, 1924. (243,017.)

29,083. "Starters for an internal-combustion engine." Soc. Anon. pour l'Equipement Electrique des Véhicules. November 18th, 1924. (Divided application on 239,809.) (243,355.)

29,904. "Electrically-heated branding iron." J. Ravella. December 5th, 1924. (244,082.)

30,038. "Manufacture of wrapping-paper for electric cables." Felten and Guilleaume Carlswerk Akt. Ges. March 4th, 1925. (Addition to 245,059.) (248,705.)

30,231. "Solidifiable paste for use in the manufacture of tubes and the like, as an electrical insulating material, as a jointing material, and for like purposes." G. Castro. November 30th, 1925. (252,999.)

30,327. "Protective relays for series release." W. H. Petersen and Allmanna Svenska Elektriska Aktiebolaget. December 1st, 1925. (253,001.)

31,199. "Method of and apparatus for producing high-frequency electric welds, and the product resulting therefrom." D. F. Pancoast. December 11th, 1924. (244,476.)

31,497. "Electric motor control systems." Metropolitan-Vickers Electrical Co., Ltd. December 23rd, 1924. (245,095.)

1926.

2,057. "Protective switches for electric motors." Siemens Schuckertwerke Ges. January 24th, 1925. (246,511.)

3,230. "Electric tumbler switch." Fabrik Elektrischer Apparate Sprecher and Schuh Akt. Ges. in Aarau. February 7th, 1925. (247,201.)

4,885. "Electric switches." Favarger et Cie. Soc. Anon. March 12th, 1925. (249,092.)

6,454. "Pressure-resisting casing for the accommodation of the coils for submarine cables." Felten & Guilleaume Carlswerk Akt. Ges. June 30th, 1925. (253,052.)

10,244. "Electromagnetic mechanisms." Automatic Telephone Manufacturing Co., Ltd., and A. E. Hudd. November 22nd, 1924. (Divided application on 251,307.) (252,649.)